RAILROAD GAZETTE

FRIDAY, JUNE 28, 1895.

CONTENTS

Contributions.

Mr. Aspinall's Report on Express Locomotives.

Lancashire & Yorkshire Railway,
NORWICH, June 13, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Herewith I send you a copy of my paper on "Express Locomotives," which has been prepared for the forthcoming meeting of the International Railway Congress in London, and ask you at the same time to accept my thanks for the trouble you have been good enough to take in the way of obtaining information for me.

I regret that very much of the information which I obtained was left out, as it arrived somewhat late in the day for me to deal with it, and I had the great misfortune during the latter months of last year to break down in health, so that I had to go away to South Africa, thus shortening the time, which was already too short, for dealing with the subject in hand.

JOHN A. F. ASPINALL.

[We publish the above letter from Mr. Aspinall as the easiest way of conveying to American railroad men who have helped him, his appreciation of their assistance and also of explaining to them the omission of some of the information which was sent.—EDITOR RAILROAD GAZETTE.]

The Convention of the American Society of Civil Engineers.

The twenty-seventh annual convention of the American Society of Civil Engineers, which assembled last week at the Hotel Pemberton, was perhaps the most successful one ever held. We believe there is no doubt that it was the largest in numbers present. Something more than 240 members, probably nearer 250, were registered, and there were very likely between 150 and 200 of their guests. The programme arranged by the Local Committee, the Committee of the Boston Society and the Committee of the Board of Direction, was attractive, and it was carried out with complete success. The only complaint that we heard was that the party was divided between two hotels at a considerable distance from each other. This came from the fact that the attendance was much greater than could have been anticipated. The weather was as fine as it could be and everything went off smoothly.

The convention began officially on Tuesday evening, with a meeting of the Board of Direction. For a great many members it began actually at 12 o'clock on Tuesday when a special train of nine cars left the Grand Central Station in New York for Nantasket Beach. It ended officially Saturday morning, but was actually continued until Monday morning of this week, a large party having gone to the White Mountains.

The most important new business transacted was the action taken on the matter of a new house for the Society. The Secretary read a synopsis of the replies received to a circular sent out, introducing this subject to the membership at large, and seeking an expression of opinion. Two hundred and sixty-six answers were received to the circular; 97 per cent. of these were in favor of building a new house; 77½ per cent. pledged a subscription either of cash or to bonds, or both. The total pledges amounted to about $52,770. It was considered by the Board of Direction that this result of the circular, together with the expressions of opinion from various members who answered, indicated that it might be desirable to build a larger house than had been contemplated at the time the circular was sent out. At the general business meeting of the society the whole matter was referred to the Board of Direction, from which we may conclude that the project will now be pushed fast if the membership is as ready with cash as it is with promises.

At the same business meeting the following were elected members of the Nominating Committee for their respective districts: (1) E. P. North; (2) W. A. Breckenridge; (3) L. F. Rice; (4) P. Roberts, Jr.; (5) J. D. Hawks; (6) L. W. Rundlett; (7) G. A. Quinlan. It will be remembered that under the constitution these members serve for two years and that besides them the Nominating Committee consists of the five past Presidents of the society whose terms were most recent.

At the same business meeting the four past Presidents, who were present, namely, Messrs. Whittemore, Worthen, Cohen and Craighill were appointed a committee on resolutions to present on Saturday morning the usual complimentary resolutions.

We have given this report of the most important results of the business meeting somewhat out of order and will now take up the programme in its order. Tuesday evening, as we have said, the Board of Direction met. On Wednesday morning a session was held for the presentation of papers, at which five papers on hydraulic engineering were presented as follows:

The Temperature of Lakes, by Desmond FitzGerald, Member Am. Soc. C. E.

Experiments on the Discharge of a 30-in. Stop Valve, by J. Waldo Smith, Assoc. M. Am. Soc. C. E.

Consumption and Waste of Water, by Dexter Brackett, Member Am. Soc. C. E.

A New Weir Formula, by Charles W. Sherman, Jun. Am. Soc. C. E.

The Separate Sewer System Without Automatic Flush-Tanks, by F. S. Odell, Member Am. Soc. C. E.

Mr. F. P. Stearns, Chief Engineer of the Massachusetts State Board of Health gave, at the close of the meeting, an excellent informal talk on the Metropolitan Water Supply System of Boston.

In the afternoon the members and their guests were taken on a long drive through the parks, passing through the Fens, the Arnold Arboretum and various suburbs and parks. The drive was the more delightful because the long string of vehicles was preceded by watering carts, which strikes one as being the climax of hospitality.

In the evening President Morison delivered his annual address, which appears in this issue, and to which we have given the title of The New Epoch and the Civil Engineer, although perhaps that is not the title which the President would have chosen.

Thursday morning papers on railroad and construction engineering were presented as follows:

The Philadelphia & Reading Terminal Railroad and Station in Philadelphia; by Jos. M. Wilson, Member Am. Soc. C. E.

The Life of an Iron Railroad Bridge; by J. E. Greiner, Member Am. Soc. C. E.

Construction of Substructure for Lonesome Valley Viaduct, Knoxville, Cumberland Gap & Louisville Railroad; by Gustave R. Tuska, Jun. Am. Soc. C. E

The Physical Qualities of Acid Open-Hearth Nickel Steel, as compared with Carbon Steel of Similar Tensile Strength; by H. H. Campbell, Member Am. Soc. C. E.

Notes on the Manufacture and Properties of Malleable Cast-Iron; by H. R. Stanford, Assoc. M. Am. Soc. C. E.

Hollow Tile Floors, Past and Present; by Fr. von Emperger, C. E.

Topography on the Survey of the Mexico-United States Boundary; by J. L. Van Ornum, Assoc. M. Am. Soc. C. E.

An informal talk by Professor Swain on the Boston Subway, which was announced for one of the meetings, was not given, Professor Swain being too busy.

In the afternoon a large party went to Plymouth, visiting Plymouth Rock and other places of historical interest. Various groups of members visited places of engineering interest about Boston this same afternoon. In the evening the business meeting was held, the report of which we have given already.

Friday morning the party was taken in two steamers on an excursion around the harbor to inspect the method of sewage disposal. This was a particularly interesting excursion; the weather was fine and Boston Harbor is, as every one knows, beautiful. The pumping arrangements and the whole system for the disposal of the sewage are very important examples of sanitary engineering. At Deer Island especially, which is the outlet of the main metropolitan sewer, the pumping plant is novel and interesting. Here are two pumping engines driving centrifugal pumps, each capable of lifting 70 cu. ft. of sewage per second, 19 ft.; also capable of raising to greater heights up to 25 ft. smaller quantities. Each engine can pump at as low a rate as 15 cu. ft. per second, and at all rates between 15 and 70. The pumps are centrifugal, on vertical shafts, and the pump wheel is to be run at from 60 to 100 revolutions per minute according to the quantity of sewage and the lift. Each pump wheel is driven by a triple-expansion Corliss engine from the works of the E. P. Allis Co., Milwaukee. The pump wheels are 8 ft. 3 in. diameter; the diameter of suction and discharge pipe 48 in.; the steam cylinders are 13½, 24 and 34 in. diameter by 30 in. stroke. The three cylinders are placed at angles of about 55 degs. and work on a common crank which turns the vertical pump shaft.

Friday afternoon a large number made a special excursion through the courtesy of Major Livermore, U. S. Engineers, to the Boston light and the lightship.

At the same time a meeting was held at which Mr. E L. Corthell presented two documents. One of these was a report on the Literary Product of the International Engineering Congress of 1893, in which Mr. Corthell describes the engineering literature which has survived in the form of printed matter from these various congresses The document is a very carefully prepared record of an important part of the World's Fair and we shall give much of it in a later issue.

The other document presented by Mr. Corthell was a résumé of communications received by him from engineering societies and individuals relative to the matter of an International Egineering Society, which matter Mr. Corthell has, as is well known, had under consideration for a good while. Both of these reports were submitted to the Board of Direction with a view to printing.

Friday evening was given up to a reception by the President of the Society, assisted by several ladies, which was followed by a dance.

Saturday afternoon a special train provided by the Boston & Maine Railroad took a large party to the Crawford House, White Mountains, where Sunday was spent, a special train bringing them back to Boston Monday.

We have no copy of the complimentary resolutions presented at the final meeting Saturday morning, but a good many people deserve the thanks of the Society. In the first place the Boston committees were most efficient. The railroad companies concerned also did their part very handsomely, the New York, New Haven & Hartford having carried a very large party from New York to the Hotel Pemberton without a cent of charge and the Boston & Maine having carried a party to and from the White Mountains. The New York, New Haven & Hartford also gave the visitors free use of the Nantasket Branch. Various municipal officers showed the Society great courtesy in providing steamers and in police and other arrangements for their comfort on excursions.

The New Epoch and the Civil Engineer.

BY GEORGE S. MORISON, ESQ.,

Being the Annual Address of the President of the American Society of Civil Engineers. Delivered June 20, 1895.

The constitution provides that the President shall deliver an address at the annual convention. It has been the custom to make this address a review of engineering works. I have thought right to depart from this custom; the year has been one of unusual dearth in engineering construction, and I feel that it is the time to call attention to the true meaning and position of the profession and the society to which we belong.

Students of primitive society have divided the early development of the human race into ethnical epochs, representing various conditions of savagery and barbarism and finally culminating in civilization. They recognize three periods of savagery followed by three periods of barbarism. In the lowest epoch men were little superior to the animals by which they were surrounded. With the use of fire the second period began. With the invention of the bow and arrow, the most primitive form of projectile, man entered the third period. With pottery, and all that it implies, he passed from savagery to barbarism. The next advance came with the domestication of animals, which gave man another power besides his own physical strength. With the manufacture of iron the last of the barbarous periods was entered. By the invention of the written alphabet the primitive race was promoted from barbarism to civilization.

To us, the first, fourth and sixth advances mean more than the others. The use of fire first placed man in a condition very different from that of other animals, giving him a power the uses of which are even yet not fully developed. The domestication of animals was hardly less important and although, where animals suitable for domestication did not exist, tribes were able to pass this period without them, their weakness was apparent when they came in contact with other races whose conditions were not so limited. Finally the invention of a written language made the work of one generation available for its successors and produced historical civilization.

The changes which mark the advances from period to period are all material improvements; in every instance they are characterized by some distinctive physical device which has enabled man either to utilize his own strength better than before or to increase his power by adding other animate or inanimate force. The race that passed from one period to another acquired resources which it had not had; in the contests which characterized the life of the primitive man the men of a lower period fell before those who had risen higher. But though the devices were of a purely material character they gave opportunities for mental and moral improvement which alone made further advance possible, till finally the written alphabet culminated in that preservation of knowledge which has made the intellectual efforts of thirty centuries available for ourselves. With the dawn of civilization the ethnical periods have been considered closed; subsequent growth has been the natural advance of civilization marked by the events which make written history.

The Manufacture of Power.—But there is no reason why the epoch which began with writing should be the last. It only needs a new capacity, radically unlike those which have gone before, to make an epoch in civilization as distinct as those in primitive society. Such new capacity has now been found; another epoch has begun. Fire, animal strength and written language have in turn advanced men and nations, but the capacity of men has always been limited to his own individual strength, and that of the men and animals which he could control. His capacity is no longer so limited; man has now learned to *manufacture*

power, and with the manufacture of power a new epoch began. I use the words advisedly. Creation, whether of substance or force, is not given to man; manufacture is not creation; but to change inert matter from one form to another in such way as to generate power, is to manufacture power.

Furthermore, not only does the manufacture of power mark a new epoch in development, but the change is greater than any which preceded it; greater in its influence on the world; greater in the results which are to come.

The manufacture of power means that wherever needed we can now produce practically unlimited power; whatever the measure of a single machine that machine can be used to make a greater one. We are no longer limited by animal units, confined by locations of waterfalls, or angered by the uncertain power of wind. Power can be had where it is needed and when it is needed; the manufacture of power has enabled us to concentrate in the hull of a single ship twice as much force as is developed by the whole water power of the Merrimac at Lowell, and this is but a trifle of what may be done.

The new epoch differs from all preceding epochs, in that, while they represented successive periods of progress, different races have existed simultaneously in every period of advancement, whereas the new epoch must from its nature soon become universal. The manufacture of power has given us the means of traversing the entire globe with a regularity and speed which brings all races together, and which must in time remove all differences in capacity. It brings people of all races into contact, and by extending knowledge, ends the superstitions and mysteries which have had such influence in the past. It enables man while working in unhealthy districts to spend a portion of his time in places favorable to physical health and bodily vigor, and so may end the climatic degeneration of race, which has done so much in history. It is gradually breaking down national divisions, substituting the natural boundaries of convenient government for boundaries based on race and ignorance. It will finally make the human race a single great whole, working intelligently in ways and for ends which we cannot yet understand.

It is not too much to predict that when the full effects of the manufacture of power are realized and the world has passed through the development which the next ten centuries will see, the time when man began to manufacture power will be recognized as the division between the ancient and the modern, between ignorance and intelligence, between the national strife which may then be classed as barbarism, and the new civilization, whatever that may then be called.

The Engineer's Place and Duties.—Great as the new epoch is, it means more to our own profession than to any other. The manufacture of power is the work of the engineer, the inventions which have led to it were made by engineers, in fact it has made possible the profession of the civil engineer.

The new epoch has barely begun, no exact dates can be fixed, epoch making is not a matter of a single invention, it is the general result which follows. It was not the manufacture of the first earthen pot but the general introduction of pottery, which carried a prehistoric race from savagery to barbarism. It was not the invention of a few letters but the general use of a written language which took the barbarian into civilization. It was not the invention of the first steam engine but the general control of the manufacture of power which is now taking mankind into the new civilization. James Watt developed his first steam engine in 1769. The steam engine began to come into general use about the beginning of this century. The 19th century has seen the development of the manufacture of power by steam. The steam engine is still almost the sole representative of manufactured power but there is no reason why this should continue. Electricity as a conveyer of power has been developed to an extent which may almost be classed with manufactured power. New forms of manufactured power may come at any time; but the introduction of new forms is a comparatively unimportant thing, the great advance came with the ability to manufacture power at all; the method is a secondary thing.

Here then we stand at the dawn of a great epoch, of an epoch making greater changes than the world has ever seen; we stand here as members of the profession which is most closely identified with this change, and which has most to expect from it. Let us study the lessons which can guide us in the duties and the responsibilities which are before us.

Let us consider what civil engineering is. Telford's definition, incorporated in the charter of the Institution of Civil Engineers is familiar to all; "the art of directing the great sources of power in nature for the use and convenience of man." The constitution of the American Society of Civil Engineers fixes as a requirement for full membership "the ability to design as well as direct engineering works." The English definition and the American requirement, taken together, explain what constitutes a civil engineer. His business is to design the works by which the great sources of power in nature are directed. His works are not built for themselves or as commemorative monuments; they are made to direct the powers of nature for the use of man. Every engineering work is built for a a special ulterior end; it is a tool to accomplish some specific purpose. Engine is but another name for tool; the business of an engineer relates to tools; a civil engineer must be capable of designing as well as handling tools. The highest development of a tool is an engine which manufactures power. All the great possibilities of our profession come from the existence of such tools.

Divisions of the Profession.—It is a common error to think of civil engineering as a co-ordinate branch of a general profession with many other branches, to class it with mechanical engineering, with electrical engineering, or with any other specific branch. The name of every special branch of engineering has a distinctive meaning; the mechanical engineer deals with machines, the hydraulic engineer with water, the mining engineer with mines, the sanitary engineer with drainage and the railroad engineer with railroads. The word civil has no such distinctive meaning; it only shows that civil engineering is the work of the citizen and not the work of the soldier. Civil engineering in its true meaning embraces every special branch of engineering. The professional limitation which should be applied to the civil engineer, is that he must be a man who, in his own department, can design as well as direct; he must have that control over his work which nothing but intelligent knowledge of the subject gives. He may be a railroad builder, he may be a skillful surveyor, he may be a mechanical engineer, or he may follow any other specialty; but whatever he does he must do it not as a skillful workman but as one qualified to design. Any man who is thoroughly capable of understanding and handling a machine may be called a mechanical engineer, but only he who knows the principles behind that machine so thoroughly that he would be able to design it or adapt it to a new purpose, whatever that purpose may be, can be classed as a civil engineer. Any skillful sewer builder and pipe fitter may claim to be a sanitary engineer, but only the man who approaches this work with the intelligent knowledge of the conditions which sanitation involves can be classed as a civil engineer. Any man who knows how to work a mine may be a mining engineer, but only he who understands why he works his mine as he does, can be called a civil engineer. Any well-practiced electrician may be classed as an electrical engineer, but only one whose practical knowledge is based on the intelligent study of electricity can be called a civil engineer. The business of every engineer is to handle tools; the business of the civil engineer, whatever department or specialty he may follow, is to design and build those tools rather than to use them. I use the word tool in its largest sense; you may call it engine if you prefer. Any constructed thing whose principal object is to produce something outside of itself, is a tool, whether that tool be a brad-awl, a steamship or a railroad.

The Civil Engineer.—Civil engineering embraces all branches of engineering, but the civil engineer differs from other engineers in that he makes tools rather than uses them. The relation of civil engineering to all other branches is of the broadest kind; no branch of engineering is excluded; the only exclusion is based on the individual qualifications of the men. The civil engineer is briefly a man who, with knowledge of the forces and materials around him, uses that knowledge in the design and construction of engineering works. His business is to design the tools by which the sources of power in nature are directed for the use of man. A body of civil engineers should include the choicest minds in every branch of the engineering profession.

Our constitution provides that a member shall be a civil, military, naval, mining, mechanical, electrical or other professional engineer, an architect or a marine architect, qualified to design as well as to direct engineering works. This would, perhaps, have been better expressed if it had said that any civil, military, naval, mining, mechanical, electrical or other professional engineer, architect or marine architect who, with the knowledge of the great sources of power in nature, uses that knowledge in the design and direction of engineering works, is qualified to be a member. We welcome into our Society all branches of engineering, but not all engineers. We welcome every engineer who applies a knowledge of the powers of nature to the design and construction of engineering works; we welcome the architect who uses this knowledge in his designs and constructions, but the architect who treats his profession as a fine art, to decorate a construction that he cannot design, belongs elsewhere. Intelligent knowledge of the great powers of nature is the fundamental requirement for a civil engineer. On this substructure a superstructure of actual design and construction must be built to make the complete professional man.

The civil engineer of the new epoch, the epoch which he is bringing into existence by the manufacture of of power, must be an educated man; in no profession will this be more necessary. The physical laws of power and strength are mathematically exact and admit of no trifling. As the epoch progresses the requirements for each individual will become more complicated. The theologian and the metaphysician may claim that an education based on the laws of matter leaves out the highest part of existence: the biologist and the physician may claim that matter endowed with life is a higher organism than the inanimate matter with which the engineer has to deal. But, however true these claims, their laws have not the mathematical rigidity, the clear definition and the thorough discipline which mark the laws with which our profession works. The engineer cannot shield himself under doctrines or theories which he accepts but cannot understand. Dealing with accurate, definite laws and guided by the corrective touch of physical nature, the education of the engineer will become more necessary, more thorough and more exact than that of any other professional man. This is the training which the civil engineer of the new epoch must have. This knowledge he must have or he must be classed as a workman rather than a professional man.

The civil engineer of the new epoch must sink the individual in the profession. The engineering work of the future must be better work than has ever yet been done. The best work is never done by separate men; it is only accomplished when professional knowledge so permeates all members of a profession that the work of one is virtually the work of all. The first steps are made by individuals, but the best results come later on. The name of Watt will ever be identified with the successful introduction of the steam engine, and nothing should be allowed to belittle his reputation, but there are ten thousand men to-day, any one of whom can build a far better engine than James Watt ever could; they can do it because they are imbued with all the work the engine builder has done for more than a century; they do it as members of a profession who are all working together. In the middle ages Gothic cathedrals were built throughout northern Europe; they are exquisite works; no modern architect can approach their beauty. The reason is that the men who built the Gothic cathedrals worked together as members of a guild which was thoroughly imbued with the spirit of building these churches. In no period of the world's history has marine construction had any significance compared with what it has today, and this is because the great ship builders are working together, each having the practical benefit of what they all are doing. They are working together as members of a profession rather than as individuals. and their work is becoming more uniform and more perfect.

The civil engineer of the new epoch must be a specialist. No man can learn to design all the tools by which the powers in nature are to be directed. The work is too great for one man to master. The best results will only be obtained by concentrating effort in a single line. But, though the civil engineer must be a specialist, his specialty must not be of a narrow kind; he must have that general knowledge and training which makes the liberally educated man. The real difference between a liberal education and a special education is that one teaches the student to use his mind and the other gives him information. The civil engineer must have had the mental discipline which qualifies the mind to investigate kindred subjects beyond the limits of his own speciality; his education must be broad enough for this or he will not be a civil engineer. The knowledge of his specialty will be only part of his education, the mental discipline will be more.

And, last, the civil engineer of the new epoch must fill many positions which are now held by men of different training. The knowledge of the tools, both large and small, which men are using must be the strongest qualifications for their use. Accurate engineering knowledge must succeed commercial guesses. Corporations both public and private must be handled as if they were machines, and the men who will so handle them will find their best training in the education which will make the best civil engineers.

The American Society of Civil Engineers.—Having now considered what should characterize the civil engineer of the new epoch, let us pass from the individual to the profession, from civil engineers to the society which they have organized. The American Society of Civil Engineers is a national society, though its membership is not restricted even by national boundaries. There are many other engineering societies and associations in our country; some of them are national, some of them are local. A full consideration of the position which our Society should hold in the new epoch must not forget these other societies.

The objects of the American Society of Civil Engineers are defined in the constitution to be "the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members," while the means to accomplish this purpose are broadly stated to be intercourse between members, professional papers and a library for professional use.

Intercourse between members is perhaps the most important of all. In no other way can the standard of a profession be raised so well. The man who works alone without measuring himself by others, never does his best. The engineer must both measure himself by what others do and let others measure him. The time of cryptograms has gone by, there will be none in the new epoch. Intercourse between members will do more than anything else to fill the requirement of the new epoch and make the work of each engineer the work of the whole profession.

The preparation and publication of professional papers is another duty of the Society. There is an important difference between the papers which must come before a society and those which are published elsewhere. Other professional publications are generally, like architectural monuments, records of what has been done, published for the preservation of those records and not for much more. The fundamental feature of the papers of a professional society, on the other hand, is that, like every engineering work, they are tools, their work begins when they are read; they are intended to bring out discussions, to compare different views, and in this way to give the knowledge of the profession to all; it is in this line that most development is needed. The papers which are now published in our *Transactions*, are many of them very good, but the discussions are not what they should be. An author may be best satisfied by the

paper which is most perfect in itself, but the paper which brings out the fullest discussion is the most useful to the Society. We have an endowed prize for a paper worthy of special commendation as a contribution to engineering science; we have another endowed prize for a paper describing in detail accomplished works of construction. There should be a third endowment for a prize for the paper which calls out the best discussion of the year, and this prize should be given without reference to the awards of the other two, so that if the paper which receives the Normal medal also brings out the best discussion it will receive two prizes instead of one.

Our Society has a professional library, but the facilities for using it are far from what they should be, and are a poor fulfillment of the constitutional requirement for the establishment of facilities for its use. Every book on an engineering subject ought to be found on our shelves soon after it is published, and engineers should find this library as convenient a workshop as the library of the Bar Association is to members of the bar. It should be open not only during the daylight hours but late into the evening so that the older engineers, who have no time in the day, and the younger men who have nowhere else to go in the evening, can realize the full benefit of its worth. In a new society house separate and safe provision for the library must be given special attention.

It will be the duty of our Society to elevate the profession of the civil engineer to the very highest rank among the liberally educated professions. This is a duty of the day rather than a duty of the new epoch. When the new epoch is fully established it will have been done, and the Society will have become the conservator rather than the promoter of the profession.

Furthermore, the main principle of the Society should be the professional principle. It must secure the very best work which can possibly be done among its members, they must not be inventors working alone by themselves. It must teach them that they are members of one profession all working together, until that spirit of professional unity is established in which it becomes impossible for any member of the Society to do bad work.

The Society must work for the profession rather than for the individual; its duties are the advancement of engineering knowledge and practice and the maintenance of a high professional standard. It must not mix itself up with the affairs of individuals; it has no secret rites or arbitrary rules; with scales of charges it has nothing to do; it will not demean its members by putting itself on the basis of a labor organization. High professional standards can never be maintained by agreements which restrict the free right of the individual to receive such compensation, large or small, as his own ability has shown he is worth; it can only be maintained by that true professional spirit which sinks the individual in the whole.

The relations which our Society should bear to the other national engineering societies, is established by the definition of Civil Engineering. Our Society should include the choicest minds in every branch of engineering; it must have among its members the leading members of every society which represents an engineering specialty. No other society can have our general range; on the other hand, no other national society can make the same restrictions as to invidual requirements. Each of the other societies is devoted to some specific branch of engineering, but the individual qualifications should be comparatively light; it receives into its ranks every engineer working in its specialty; as we receive engineers of every specialty but not every engineer.

The American Society of Mechancal Engineers accepts as a member one who is "competent to take responsible charge of work in his department;" it is not nessary that he should be able to design and while this would be a bad provision for our Society, it is exactly right for the Society of Mechanical Engineers. We take in the educated men of every branch of the profession, each other national society takes in every man who is devoted to the specialty which that society represents. There can be no conflict between those societies and ourselves; it may be hoped that in time every one of our members will belong to at least one of these other societies.

The relation which our Society is to bear to the various local societies is of a different character. These societies are intended to bring together the engineers of the immediate neighborhood in which they are established. Their opportunities for social intercourse and for frequent discussions are necessarily greater than those of any national society. Their requirements for membership should be more liberal than those of any national society. Like our Society they should receive members from every branch of engineering; like the Mechanical and other special societies they should admit every one who is qualified to take responsible charge of work in his department. The qualifications for a member of the Western Society of Engineers, the Chicago local society, are simply that he must have been engaged for five years in some branch of engineering. It would be an appropriate thing for those local societies who now have it in their title, to drop the "civil" and let them all become "societies of engineers," restricted only by convenience of location.

The relation of our Society to societies of the other two classes may perhaps be likened to the three dimensions of space. Our Society has a length which is defined by no geographical limits and a breadth which is bounded by no engineering specialties, but its depth is limited by the qualifications of individual men. The other national societies have the same indefinite length that we have, but the breadth is limited to the specialty which characterizes each one of them, while the depth is unlimited, as they take in every engineer who follows this specialty. The length of the local societies is confined to the geographical limits which they represent, while the breadth and the depth are both unlimited.

As the national societies all have their headquarters in the same city, any engineer residing in or near New York may find all that he needs in one or more of the national societies, but it is hoped that in time every non-resident member will also be a member of one of the local societies.

The differences between our Society and the several other classes of engineering societies are of so radical a nature that it would be a dangerous thing to try in any way to consolidate or unite them. We cannot unite without entirely changing the qualifications for membership. No idea of uniting with the other national societies has ever been suggested. We cannot unite with the various local societies without either so widening the qualifications of our membership that we shall cease to be a society of civil engineers or so restricting the qualifications of their membership that the ranks of many of them would be destroyed.

But, though we cannot unite with any of the other societies, it is our duty, as the leading engineering society of America, and one of the leading societies of the world, to treat all other technical organizations with the same generous kindness and courtesy which should characterize the treatment of gentlemen by gentlemen, of professional men by each other. The members of the different local organizations should be welcomed to our headquarters, and we should freely exchange our publications with other societies, esteeming it a privilege if we are able to give them more than they give us.

The Engineer's Tools.—Let us now pass from general considerations to actual work. Engineering tools may, for convenience, be classified on the basis of their approach to the manufacture of power. The first place may be given to the tools which manufacture power, the second place to those which transmute power, the third place to those which transmit power, and after this the rank and file of miscellaneous tools may follow

The only tool in general use for the manufacture of power is the steam engine. . . . The tools which transmute power are principally two, the water wheel and the windmill. . . . In tools for the transmission of power the progress of the last few years has far exceeded all that had ever been done before. So long as engineers sought to utilize electricity to manufacture power they failed, but when they adopted it as a means of transmitting power the results became superb. The dynamo, though logically a tool to transmute power, is practically more properly classed as part of the general tool for electric transmission of power.

Without attempting an exhaustive division, three classes of the more general tools may be mentioned.

The first of these are tools of transportation, of transportation by land and of transportation by water. By land, the steam railroad system has become a tool of such magnitude that to many it has seemed as if no man could be a civil engineer unless he were also a railroad builder. The wild extensions built rapidly and carelessly through unsettled territories, or with less rapidity and greater carelessness where not needed in the older districts, are nearly done; but an immense work remains in improving terminals, developing better local facilities and generally bringing these great railroad tools into a condition in which they will perform their own duties better and interfere less than now with other work. In a distant part of the world a railroad is building which cannot fail to have a great influence in the new epoch. Twenty-six years ago the American continent was first crossed by a railroad reaching from ocean to ocean; seven years hence the Trans-Siberian Railroad will complete a continuous line across the older and greater continent, eastward instead of westward, from the Atlantic to the Pacific. This new railroad, passing around the most populous portion of the globe and the seat of a civilization now farther than any other from the conditions of the new epoch, may do more than any one thing to render that epoch universal. In about a century from its first general introduction, manufactured power will have crossed both continents, and by the aid of manufactured power on the ocean it will be possible to make the circuit of the globe in about 40 days. . . .

The waterway and the boat that navigates it are equally tools of transportation The advances in marine engineering, and especially in the ocean marine, have been most marked, the development being both in the manufure of the hulls, which are now almost invariably built of steel, and in the development of higher steam pressures through the compounding of engines, until the latest addition to the fleet of full powered ocean steamers, the St. Louis, built at Philadelphia, carries a steam pressures of 200 lbs., and develops her power through two quadruple expansion engines. The advances in lake marine have benn almost as great as those in the ocean marine, but all this time our Western rivers are navigated by boats which differ little from those which ran upon them 50 years ago. They still have the wooden hulls, the long stroke, high-pressure, horizontal engine, the big separate side wheels and the battery of small boilers; their machinery is a little better than it was at first, the pressures they carry are a little higher, but the changes are so slight as to be insignificant. The channels of the principal Western rivers are being constantly improved under the direction of the general government, but as yet no response has been made to these improvements by the radical improvements which ought to come in the boats and their engines. Much is said of the decline of river business; it has declined because land transportation has given better and cheaper facilities; until the boats of the Western rivers make the same advance that other tools of transportation have made, this business must continue to decline.

Another very important class of tools are the sanitary tools. The history of the world is filled with stories of pestilence which could have been avoided entirely by proper attention to drainage and water supply. There is no branch of engineering which is so directly associated with the convenience of man. The larger sanitary tools, unlike the tools of transportation, are generally constructed by public and not by private corporations, and this makes it necessary to build works which the public can understand, where the educated civil engineer may feel that a different thing would be better. . . .

The other classes of tools need be referred to but briefly. Among them are the tools for general commercial use, such as warehouses and office buildings, in which a decided change has taken place within a very few years. Heavy masonry walls are being discarded in our large cities and skeleton structures of iron and steel are being adopted as the most convenient and economical tools. These buildings must not be confused with the great monumental buildings of the world, they are tools rather than monuments; their construction belongs to the engineer rather than to the architect. They are still marred by inappropriate decorations patterned after masonry construction, but the method of construction has been adopted because it gives ecomonical results and so with the least expenditure of money produces a tool of greatest profit. The durability of oxidizable metal may not be that of masonry; it remains to be proved how durable these buildings are, but as economical structures they are excellent tools. It is interesting to note that in New York City not only is metallic construction being applied to all commercial buildings but the same methods are being used for the foundations of these buildings that have been proved to be most efficient under great bridges and works recognized as strictly of an engineering character. . . .

We have met at this convention in the oldest part of our country, in the harbor of a great city whose origin distinctly antedates the beginning of the new epoch. Boston was founded 139 years before Watt perfected his steam engine; it existed for nearly 200 years before the general manufacture of power. In the later centuries of the new epoch it will be regarded as a city of ancient origin. In this community are men whose rank is among the very highest in the design of the highest class of tools, the engines which manufacture power. The leading hydraulic engineers of the country, whose business is to transmute power, have lived here. The Boston local society is the oldest engineering society in America. It is the section of our country which boasts the oldest university, the largest public library and the greatest proportion of educated men. And yet it is perhaps more necessary here than in any other part of the world to emphasize the real nature of our profession. I speak as a son of Massachusetts who, though much of my life has been spent elsewhere, have never wholly separated from New England. The ideas of the old epoch were stong; it was hard for the people of Massachusetts to recognize the importance of the civil engineer; the prejudices of the Puritan and of the old time liberal professions were inherited from the past. There was not always a full conception of the real meaning of the construction of tools; Yankee ingenuity was thought enough to meet all requirements and men of liberal education justly considered that work which native ingenuity did without training could not be ranked as professional work. Such men did not appreciate the civil engineer because they did not understand his work, they missed the distinctive requirements which make the civil engineer and confounded the profession with men who did not belong to it. Let it now be known distinctly that our profession is one of training and education. The civil engineer is an educated man whose knowledge of the sources of power in nature enables him to direct them for the convenience of men.

The tools which we have to build are generally large. The physical man is often a tiny thing beside the work which he has to construct. Nothing illustrates the power of mind over matter better than our work. If our work is of a material kind, it is the mind which has made this matter give forth power, it is the mind which is opening the the new epoch, and it is by the training of this mind that the civil engineer must prevail. We are the priests of material development, of the work which enables other men to enjoy the fruits of the great sources of power in nature, and of the power of mind over matter. We are priests of the new epoch, without superstitions; but if our profession is to do the good work of which it is capable the true spirit of individual immolation, which has characterized the devoted priest of all ages, must be found among ourselves. The profession can only do its future work by trained minds working together.

Car Service Managers' Convention.

The Sixth Annual Convention of the National Association of Car Service Managers was held in the rooms of the Chamber of Commerce, Cleveland, Ohio, on June 18 and 19. There was a large attendance of managers, repre

senting car service associations from New England to Texas, and from Duluth to New Orleans. The President, Mr. F. E. Morse, presided. The managers were welcomed in an interesting address by Mr. L. F. Loree, Superintendent of the Cleveland & Pittsburgh.

The object of this Association is purely instructive. Subjects of direct interest and benefit to individual members and the companies represented were generally discussed. The principal papers read were the following: The Commercial and Railroad Side of Car Service, A. L. Gardner, Baltimore; Shall the Car Service Association be a Collecting Bureau? A. J. Elliott, Peoria; Effect of Car Service Work on the Railroad Business in New England, E. A. Gordon, Providence; Benefits Obtained in Having Checking of Tracks and Making of Bills and Collections, Done by Employees of the Association, D. T. Bacon, Indianopolis; The Car Service Association of the Future, A. M. Simmons, Cleveland.

The papers of Messrs Bacon, Gardner and Elliott were given in our last issue. Mr. Gordon's appears in this issue.

Officers for the ensuing year were elected as follows: President, A. P. Wilder, Topeka; Vice-President, N. S. Hoskins, New Orleans; Secretary, A. G. Thomason, Scranton, Pa. The next annual meeting will be held at New Orleans.

Why the Free Time in New England is Ninety-six Hours.*

Up to three years ago New England was looked upon by Western roads as a "graveyard" for cars; they were only returned when driven home by lost car agents or for general repairs. The Eastern roads recognized the evil, however, and many years ago promulgated a 24-hour rule, which was occasionally enforced, but it became a dead letter. Early in 1888 the first agreement to make a uniform demurrage charge was entered into by the Boston & Albany, Boston & Maine, Central Vermont, Fitchburg and New York & New England railroads, and notice was given to the public that 48 hours would be allowed, after which a charge of 75 cents per car per day would be made. Agents made daily reports to their accounting departments, and claims were adjusted by the traffic departments. While this agreement was effective the improvement was very noticeable, particularly at stations which were blockaded most of the time; but pressure was brought to bear by heavy shippers and receivers and large amounts of charges accrued at important competitive points, payment of which was refused on the ground that it could not be legally collected. In the meantime receivers of freight in Connecticut promptly got a law passed allowing four days for loading and unloading of carload freight at all points within the state. There was a general complaint in other parts of New England that the charges were too severe. With a view of lessening the objections to the rules, a revision of the tariff was made, allowing four days for unloading, the charge per diem after the free time to be 3 cents per ton for the first five days and increasing thereafter. This system required considerable bookkeeping, and unfortunately the lading of the cars gradually dropped to a standard of 10 tons per car. The practical failure of the agreement followed.

Not until April, 1892, was any further movement made to introduce car-service rules in New England, when the Central New York Association secured a foothold in Southern Vermont, and from that time on the advance has been comparatively rapid. On Nov. 1, 1892, the rules of the Rhode-Island Car-Service Association, allowing 48 hours, became operative in that state, and the results were beyond expectation. Tracks which had been lost to view for months gradually made their appearance, and cars for which consignees had held invoices for months and had almost given up, found their way to delivery tracks and were unloaded. The railroad companies that in September, 1892, were endeavoring to buy land for storage purposes, at several thousand dollars per acre, stopped negotiations, and within 90 days had land to sell.

It should not be assumed that these results were brought about without some friction with the public. A suit was brought against one road for holding a portion of a carload of freight for non-payment of car-service charges. When this suit terminated in favor of the road an appeal was made to the legislature to adopt the Connecticut law, with clauses making it more severe on the roads, and a proviso requiring the roads to pay demurrage for freight detained. Had the bill become a law Rhode Island would have been flooded with "consigned" shipments, and a *paymaster* would have been a necessity, as well as a cashier. To prevent the passage of this bill a compromise was effected by extending the time from 48 hours to 72 hours.

In July, 1893, car-service rules, based on the statute, were put in force at all freight stations in Connecticut, with the usual good results. A month later some forty (40) stations in Massachusetts were placed under the jurisdiction of the Connecticut Association. On Jan. 1, 1894, the Massachusetts & New Hampshire Association applied a four-day rule throughout Massachusetts and New Hampshire with the exception of the extreme northern portion of the latter state, and that has since been brought into line. Many years ago the New Hampshire Legislature made a law compelling the railroad companies in that state to allow five days for the unloading of cars. In revising the statutes, a few years ago, this statute was omitted, and consequently there is no state law governing the car-service question in that state. It was believed, however, that if a straight 48-hour rule was enforced by the roads the old statute or something worse, might be resurrected. That, in connection with the Connecticut State law, caused the Massachusetts & New Hampshire Car-Service Association to adopt the 96-hour rule, and the Rhode Island Association extended the time allowed in that state, on Jan. 1, 1894, to 96 hours in order to avoid the charge of discrimination and to make the rule uniform.

One would naturally suppose that so liberal a rule would have met with little opposition, but after several years' study of this question, I am led to believe that it is not the limit of 48, 72 or 96 hours allowed, but the restriction itself that proves obnoxious. Practically as many cars earn service in Rhode Island under a 96-hour rule as earned service under the original 48-hour rule, so that from a financial standpoint the public is no better off than under the latter rule, while the loss to the railroad companies has been noticeable.

In February, 1894, some six weeks after the rules of the Massachusetts & New Hampshire Association took effect, a bill was introduced in the Massachusetts Legislature ingeniously worded so as to secure a 96-hour average basis for unloading, but it was voted down. There was then a general feeling that we had seen the last of legislative hearings on the car-service question, but in February of this year a bill allowing six days for unloading cars was introduced in the Connecticut Legislature. The committee, however, has returned it to the house with a recommendation that it be withdrawn, and no further trouble is expected during this session.

The result of these struggles has been to weld the roads in the Associations more firmly together, and I believe that they are more solidly established to-day than ever.

* A paper by Mr. E. A. Gordon, Manager of the Connecticut, the Massachusetts & New Hampshire and the Rhode Island Car-Service Associations, read at the Convention of Managers at Cleveland, June 18.

Safe Speed of Trains at Grade Crossings.*

The distant signal, as now operated at grade crossings, would seem to be an element of danger. The joint committee on interlocking and block signals, in a report to the American Railway Association, Sept. 7, 1893, defines the distant signal as "a fixed signal of distinctive character, used in connection with a block or other fixed signal and placed at sufficient distance therefrom to regulate the approaches thereto." If the distant signal was operated as here implied there could be no argument against its use. In addition to the above definition, the function of the distant signal is to indicate the position of the home signal; and in so far as doing this, it is desirable where the speed of trains is high. But there is no mechanical appliance compelling the towerman to operate the distant when the home signal is cleared, nor any insuring its position when once cleared until such time as the train has passed the home signal. If it constantly remains at caution when it should be cleared, it is finally ignored and no attention paid it by the trainmen.

Collisions have been averted solely by the good judgment of the engineman having the right to the crossing. Not long since, on a Chicago line, a freight train passed under the distant signal at clear (running at 25 miles an hour) but when about 600 ft. from it the engineman noticed the home signal at danger and the derail open. Unable to materially check the speed of his train in that distance it was derailed, and by reason of the guard rail ran 75 ft. over the crossing, the engine going on the ground at that point. A passenger train on the crossing road had the signal, and a collision was avoided by but a few seconds.

There are several ways to overcome the difficulty, in a measure at least.

1. To eliminate the distant signal entirely, putting such restrictions on enginemen, requiring them to approach the crossing with train under control.

2. To establish slow boards in place of distant signals.

3. To locate the distant signals 2,000 ft. or more from the home signals with the derail 1,500 ft. from the crossing and guard rails not to exceed 2,500 ft. in length.

It would seem that the safest arrangement is to establish slow boards. These would serve to direct the engineman's attention that he was approaching a crossing and at that point should bring his train under control, expecting to find the home signal at danger. If the position of the home signal can be seen from the slow board, the train may proceed without appreciable reduction of speed. On the other hand, if the home signal is obscured the speed should be materially reduced. . . .

*A paper read by W. J. Gillingham, Jr., before the Railway Signaling Club, at Chicago, June 4. (Condensed.)

Baltimore Belt Line Power Station and Equipment.†

The power house consists practically of two separate plants, the power plant and the lighting plant. The power plant consists of four tandem, compound, non-condensing Allis-Corliss engines, with cylinders 24 in. and 40 in. in diameter by 42 in. stroke. These engines will develop about 700 H. P. each. The balance-wheel weighs about 35,000 lbs., which, in connection with the balancing effect of the armature, is sufficient for the best results in regulation.

The four generators, whose armatures are keyed directly upon the shafts of the engines, are of the multipolar type, each machine having 10 poles, 10 brushes, compound wound, and capable of delivering 500 K. W. at 700 volts, running at 110 revolutions, giving a capacity of about 3,000 amperes. The leads from these machines to the switchboard are of stranded copper about 1¼ in. in diameter. The switchboard, which contains the ammeters, circuit breakers, rheostats, etc., is placed at the south end of the engine room, so that anyone standing by the switchboard has a view of the entire engine room and complete control of the four generators. The north end of the power house is occupied by the lighting plant, of four standard Armington & Sims cross-compound, non-condensing, double-disk, two-wheel, self-contained engines, whose cylinders are 16½ in. and 23 in. in diameter by 15 in. stroke. Two of these engines are belted directly to 8 50-light arc machines, using tandem belting. They run at about 250 revolutions, and develop 250 H. P. each. The balance of the lighting plant consists of the other two of these engines, which are belted to two 120-K. W. alternators. These machines, at about 1,000 revolutions, develop about 1,000 volts, used for incandescent lighting. The switchboard controlling these machines is placed near them, at the east wall, and consists of an arc plugboard which controls the arc lights, two alternator panels, and two feeder panels, which control the incandescent lights.

The boiler room contains eleven 250 H.-P. water-tube Abendroth & Root boilers, 130 lbs. pressure, one 3,000 H.-P. Webster feed-water heater, two Deane pumps, and the entire piping of the plant is duplex, to provide for accident. The Holley drip system is used in connection with the steam piping. The top of the stack is only 60 ft. above the grate surface and only 7 ft. in diameter, the induced draught system being used. Two draught fans give a maximum velocity to the flue gases of about 36 feet per second, and are operated by a small engine placed directly under them.

The overhead conductor of the current for the locomotives is an iron trough which is composed of two Z-bars riveted to a cover plate 12 in. wide, and leaving a slot 1 inch wide between the Z-bars, so that a contact-maker may be drawn along through this trough.

This contact maker is a large brass shoe, over 2 ft. in length and 7 in. in width. It will weigh about 25 lbs., and is connected to the locomotive by a device which automatically adjusts itself for different heights of conductor and curves.

The locomotive is made up of two units, each consisting of an iron truck frame, supported by four driving wheels. The motive power is furnished by two 6-pole axle motors; these motors are flexibly supported and transmit their power to the wheels by means of flexible connections. The total weight of a single motor is about 25,410 lbs.

The locomotive is equipped with sheet iron cab, series-parallel controller, electric air pump, air brakes, air whistle, bell, safety devices, etc. It also has a Janney automatic coupler at each end.

Weight	95 tons
Draw-bar pull	47,500 lbs.
Height over all	14 ft. 3 in.
Length over all	34 ft. 8 in.
Width over all	9 ft. 6¼ in.
Wheel base of each truck	6 ft. 10 in.
Diameter of driving wheels	62 in.
Number of drivers, cast-steel centers and steel tires	8
Size of journal	6 × 8¾ in.
Gage	4 ft. 8½ in.
Voltage	500
Maximum speed per hour	50 miles
" " full draw-bar pull, per hour	15 "
" " half " " "	30 "
Number of amperes at maximum draw-bar pull and 15 miles per hour	2,700 amperes

The motors are wound for 250 volts and are to be run two in series.

The track, which is used as part of the return circuit, is very heavily bonded with copper wire, and between the tracks is laid in a wooden trough a large copper cable, cross connected to these bonds electrically; thus all four rails as well as this heavy copper cable carry the return current.

Storage Batteries.*

While the day of golden dreams for storage battery companies is past and the Patent Office is not burdened with applications for patents on batteries with millions in them, as in former years, a few strong companies are quietly recovering much of the ground which has been lost. The battery of to-day at diminished cost is available for many kinds of service. I have recently had some experience with the battery made by the Electric Storage Battery Co., the Chloride Accumulator.

Heretofore our local instruments in the Chicago office have been operated by Crowfoot batteries. While they filled a long felt want they also filled a room which was required for office purposes, and they demanded perpetual attention. The whole outfit has been displaced by four chloride accumulators which operate 20 sounders and 2 repeaters in constant use. Two of the batteries are always in use and the other two are at the same time being charged from the electric light wires in series with the lamps which light the office and operating room. The current absorbed by the charging batteries is not enough to materially affect the light given by the lamps and as it is furnished by our own lighting plant the cost is hardly sufficient to justify the estimate. Even if purchased at the usual rate I do not think it would amount to 10 per cent. of the cost of renewing the old Crowfoot batteries. So satisfactory has been the service that we are about to equip our phonoplex circuits. There are, of course, many small offices where no current can be reached, but it is worth considering whether, in view of the superior service of the storage battery, it may not be advisable to send out charged batteries and have them returned when used up. We were agreeably surprised to find that the cost of the storage batteries was but 50 per cent. more than the primary batteries displaced; a difference which will be more than made up by the saving in renewals, not to mention the saving in time and trouble.

The storage battery is steadily regaining lost ground in the great field of light and power. The catalogue of the battery company above referred to contains a surprisingly large list of plants installed by it, many of them of great capacity. I recently had the pleasure of inspecting the fine plant now running at the United States mint in New Orleans. They have 54 cells of two volts each, with normal disharge of 240 amperes, charging the battery during the day and furnishing 200 16-C. P. lights at night. The superintendent informed me that they had already effected a saving in their running expense of $1,050 since the installation of these batteries, which has been just six months.

Disturbing Currents on Telegraph and Telephone Wires.†

Mr. Lockwood divided these troubles into electro-static, electro-dynamic and conduction by earth, trees or supports. The most usual trouble is leakage between different wires attached to the same supports. The most common remedy has been patented four times. This is to run a ground wire near to each insulator. A better remedy is to improve the insulation. Electric railway disturbing currents frequently manifest themselves through trees, the current reaching the wires by way of the foliage. Where owners will not permit trees to be trimmed the "weathercross" leakage conductors above referred to are often useful. If the receiving instrument be a telephone, it may be shunted by an electromagnetic coil—called diversely a retardation coil, a choking coil, an obstruction coil, or an impedance coil, constructed of such proportions, and of such relation between the iron of its core and its winding, that it will freely allow the passage of the slowly changing disturbing current, such as that of the railway; but will be practically impervious to the telephonic current which changes at a rapid rate, sometimes rising to a rate of 200,000 times per second.

Disturbances from electric railroad wires make the most trouble when they come in by the terminal ground wires. A return circuit is the most radical remedy. If we are dealing with leakage interference only, there is no necessity for arranging the two wires in parallelism, or equidistant from the disturbing circuit, and the circuit may, if desired, be in the form of a ring, just as a fire alarm, or messenger call circuit, where the only desiderata are to keep the circuit free from grounds, and from trouble coming by way of the grounds. If electric railroads would employ the double trolley, this trouble would be obviated.

If the wire is short, let it be doubled by all means, and the two wires should be close together. Where there are a number of disturbing currents a common return wire, large and of low resistance, is often the best remedy.

* Abstract of a paper by Mr. C. F. Annett, of Chicago, read at the Convention of the Association of Railway Telegraph Superintendents, Montreal, June 14, 1895.

† From a paper read by Dr. Louis Duncan at the meeting of the Railroad Telegraph Superintendents, held in Montrea June 12 and 13.

† Abstract of paper by Mr. T. D. Lockwood at the Montreal Convention of Railroad Telegraph Superintendents, June 12 and 13.

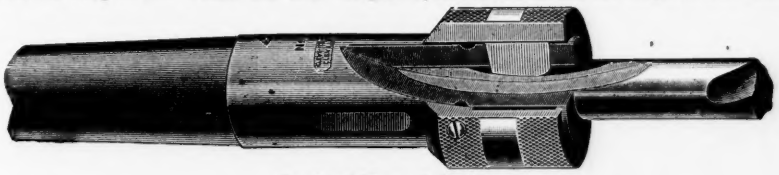
The direction and strength of battery currents should be harmonized with the disturbing current. In telephones the electro-magnetic shunt is applicable.

Electro-static induction is met with chiefly in electric railroad wires. It will interfere at distances of 150 ft. to 1,000 ft. The better the insulation the worse the induction, because with high insulation there is slow discharge. If leaks are distributed along the line they lessen the trouble from induction; but leaks become escapes and ultimately are grounds. Ground wires on the poles, as before described, are a partial remedy, especially if such a wire is connected from pole to pole in the form of a flat strip, making an inductive screen. A plan which has been tried and found useful in many cases, for disturbances originating in static induction, is to cable the wires through the affected district, coating each insulated wire of the cable with metal, such as tinfoil, and associating with them a bare wire, grounded at frequent intervals. This expedient also is of the nature of a screen. If you can afford it multiply the line wires.

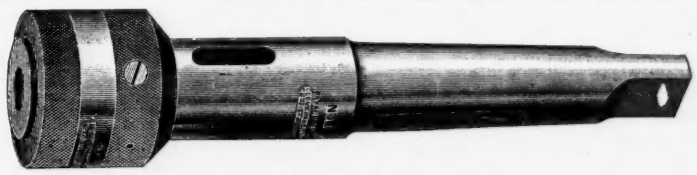
Magneto-electric induction—which term is often extended to mean all kinds of telephonic disturbance—can be completely remedied only by a metallic circuit. It is not enough, however, that the two wires of such a circuit be of the same length and resistance; they must be equal, including the resistance of the instruments and appliances connected with them. Where an arc light circuit causes disturbance relief can sometimes be obtained by having half the lamps on one conductor, and the remaining half on the other. It is sometimes possible, to quiet wires by transposing them on the poles.

An Improved Grip Socket.

The Cleveland Twist Drill Co., of Cleveland, O., has designed a new form of grip socket for holding and driving taper shank drills and other tools. A groove, which is an arc of a true circle, is milled in the shank of the drill or tool, as shown in the illustration; a key let nto the body of the socket fits into the groove, and is



Sectional View of Socket.



Socket Ready for Use.

ocked securely in place by a turn of the revolving collar. This collar is eccentrically counterbored internally. After the key is locked, it is impossible for the tool to slip in the socket or to be pulled out until the collar is turned back again to release the key. The end of the collar is beveled, and an index mark on it and on the body of the socket shows when the key is released.

The Master Mechanics' Convention.

We gave last week President Garstang's address at the opening of the twenty-eighth annual meeting of the association. After this address a short recess was taken. Mr. Eugene Chamberlain, after a few well-chosen remarks, then presented gold badges to each of the following ex-presidents: Messrs. Barnett, Wells, Setchel, Briggs, Mackenzie and Hickey.

Messrs. Garstang, Wells, Setchell, Briggs and Mackenzie, the ex-presidents, who were present, made appropriate remarks in acknowledgment of the presentation.

On motion of Mr. Mackenzie the minutes were approved as printed.

The Secretary's report showed the membership to be as follows: Meeting of 1894—Active, 552; associate, 17; honorary, 18; total, 587. Meeting of 1895—Active, 566; associate, 17; honorary, 17; total, 600.

At Alexandria Bay, in 1888, the Association had a membership of less than 300, the membership having doubled since that time. The report of the Treasurer showed: Receipts, $3,583; expenses, $3,091, leaving a balance of $492.

The reports of the Secretary and Treasurer were received and referred to the Auditing Committee.

The President announced that the annual dues had been fixed at $5. The President appointed the following Auditing Committee: Messrs. W. A. Nettleton, S. Higgins, L. R. Pomeroy. The election of Prof. W. F. M. Goss as an associate member was unanimously recommended by the Committee on Membership and he was duly elected. The Executive Committee decided that any member two years in arrears of dues would not be allowed to vote. Mr. Gordon proposed the name of Mr. S. A. Hodgman, now an active member, for honorary membership, and Mr. Hodgman was duly elected.

The reports of committees was declared to be in order. The Secretary read a letter from Mr. Robert Quayle, Chairman of the Committee on Exhaust Pipes, Nozzles and Smokestacks, in which he said that owing to his having been transferred during the year from one location to another, and the testing apparatus being at South Kaukauna, where he was previously located, he had been unable to conduct any experiments. He stated that he had fitted up a new testing machine at the West Chicago shops of the Chicago & Northwestern, far superior to the old one, which would enable the committee to give valuable data on the subject. Mr. Briggs moved that the committee be continued another year.

MR. D. L. BARNES: I am a member of the committee and will make a short report, as I am not satisfied with Mr. Quayle's letter. It is an important topic, and the reason we have not done anything this year is not because we have not had an opportunity, but because we have not had the money. The Purdue testing laboratory has been available, and $150 would have enabled us to make a report. We could not get it, although it is a small sum of money to stand in the way of a valuable report on exhaust nozzles. The work, as taken up the year before last, is not quite complete, and a few more experiments need to be made, and I move that this matter be considered under the head of the report of the committee on shop tests of locomotives, in order that the question of expenditure may receive attention at that time.

MR. GENTRY: A reference to this matter in the letter would have helped the committee to get the funds.

MR. HERR: Mr. Quayle has just completed a testing plant at the West Chicago shops of the Chicago & Northwestern, similar to the one on which he did such valuable work at Kaukauna. I agree with the remarks made by Mr. Barnes that an appropriation should be made in order to get the fullest benefit possible from the work of this committee. There is a plant at Purdue University admirably adapted to continue the work of this committee.

MR. BARNES: At the last meeting of the committee it was agreed to ask this Association if any of the members had had experience with the exhaust nozzles and apparatus that we recommended last year. We heard that in one trial it had been a failure; and if so the committee should know it. I would like to know if any of the members have tried the plan and found any part of it defective.

MR HERR: On the Northwestern we had a large number of engines equipped on the lines recommended by the committee as far as the front end appliances are concerned. These engines have given admirable satisfaction. There is little to be desired, as far as they have outlined, fixing the relative position of the choke of the stack and the height of the nozzle.

MR. HIGGINS: I did not understand that a recommendation had been made as to the proper height of the exhaust nozzle and choke of the stack. We have adopted the recommendations of the committee with some new locomotives and we are getting good results. The engines steam very freely, have plenty of speed and are economical on the coal pile. The nozzle is about 22 in. high; the top of the nozzle about central with the flues. The extension front was the same as recommended by the committee last year, being just wide enough to admit the use of the cinder hopper. Can Mr. Barnes tell us what amount the committee will need to go ahead with the work?

MR. BARNES: It depends upon what the Association wants done. I know what Mr. Higgins' departure is—it is an admirable one, but different from what we experimented upon, except the tapering of the stack. Our recommendation was to have a low nozzle, tapering stack, with a certain shape of base and short smoke-box, no longer than the cinder pocket would require. If the Association wants double nozzles tried—which we ruled out, but which we have had several requests to try—that would take more money than to go ahead and finish with the single nozzle. I think after learning what is desired we can furnish an estimate quickly. The changing of the apparatus is cheaply done. It only requires to pay for fuel and attendance.

MR. BROWN suggested that the Association pay this.

MR. MACKENZIE: It seems that Mr. Quayle has taken it upon himself, together with the committee, to make these tests in his own shop; and it would be nothing more than right for the Association to pay for the coal they use on the engine, at least. I move that the Committee on Exhaust Nozzles, Stacks, etc., be empowered to draw upon the Secretary for sufficient funds to pay for the coal used in conducting the tests.

No action was taken in the matter at this time.

The report of the Committee on Fire Kindlers was then read by Mr. Hill.

FIRE KINDLERS.

The Committee on Fire Kindlers reported at some length, chiefly on tests of the Leslie Kindler; we make the following abstract:

The plan of introducing the oil fire under the grates was tried with the belief that this was the proper place to light coal. Heavy loss resulted from radiation from the ash pan. The fire was not kindled so well as when fire was placed above the fuel. Oiled waste was tried and independent kindlers, using a can of oil, flowing by gravity to the kindler. Such devices are cumbersome and increase labor and fire risks. The cost of compressed air has never been charged to oil kindler expenses. We think it need not be for purposes of comparison with wood, since there are expenses in handling wood fuel not charged against it for fuel, more than compensating for the cost of compressed air. By experiment it was found that a standard main air reservoir containing 15,800 cu. in. of air under 70 lbs. pressure kindled three fires in eight-wheel engines, using about 300 lbs. of fuel each. This shows the amount used to be not excessive.

It seems proved that the oil kindler has passed the experimental stage. It costs about $20 per stall, which is easily saved in a year by its economy over wood.

The Le Bel Kindler is in use on the Canadian Pacific, the Fitchburg and the Vermont Central, and is made up in brickettes 6 in. × 2 in. × 1⅛ in., composed principally of rosin, fuel oil and sawdust. Four to 10 pieces are used to light a fire, the smaller number being enough for ordinary eight-wheel engines. It comes in boxes of 100 and costs between one and two cents per stick. The following table shows the results of a number of tests made to ascertain the difference in time of getting up steam, using the Leslie Kindler and dry, hard wood with various engines, with and without blower, also using oiled waste:

Oil.			Wood.			Remarks.
Steam.	Time.	Cost of oil.	Steam.	Time.	Cost of wood.	
50 lbs.	1 hr. 36 min.	2.56 cts.	50 lbs.	1 hr. 48 min.	33 cts.	With blower.
75 "	2 " 33 "	2.56 "	75 "	4 " 5 "	33 "	Without blower.
100 "	5 " 7 "	5.40 "	90 "	2 " 42 "	56¼ "	Without blower; fire above grates.
120 "	2 " 37 "	5.40 "	.....	.....	.... ..	With blower; fire above grates.
45 "	2 " 10 "	5.40 "	.....	.....	.....	With blower; fire below grates.
130 "	1 " 58½ "	2.00 "	117 "	1 " 19 "	22 "	Oil, heavy blower; wood light do.
121 "	2 " 1 "	2.00 "	135 "	1 " 53 "	22 "	Light blower; Smith exhaust.
142 "	2 " 19 "	2.00 "	105 "	3 " 37 "	22 "	Blower, 45 min., used with oil only.
117 "	1 " 58 "	1.88 "	108 "	2 " 47 "	26¼ "	Oil, above grates; wood, without blower.
58 "	1 " 33 "	0.75 "	.....	.....	.....	Oil, below grates.
70 "	1 " 46 "	2.30 "	45 "	1 " 40 "	38½ "	Without blower.
65 "	1 " 5 "	2.30 "	65 "	1 " 16 "	19¼ "	With blower.

Oil.			Waste and oil with blower.		Cost oil and waste.	Remarks.
125 lbs.	2 hr. 36 min.	2.70 cts.	50 lbs.	2 hr. 35 min.	11.8 cts.	Blower, with waste only.
120 "	1 " 42 "	2.60 "	30 "	1 " 24 "	17.6 "	Blower on both engines.

The Committee considered in this connection that involve more than the kindling of the fire. Would there be any greater number of stay-bolts broken in firing up by these methods than other fuels; and is it going to have any influence on the cracking of fire-box sheets. There are also some other methods in use that require no more plant than those that have been mentioned. I think of one now in which it is the practice to use two sticks of wood in connection with about four quarts of soaked waste in the kindling of a fire. This is successfully practiced in several hundred stalls at the present time, and requires no plant thus permitting its use at small points, like branch-line runs, where but two, three or four engines are housed. There is another consideration, and that is the use of the blower—whether that is desirable in the firing of an engine.

MR. HILL: The data given in these reports cover every point that Mr. Manchester has made. Tests have been made with and without blowers in every conceivable way. Oil kindling has reached a point where we know about all there is in it. I hope the committee will not be continued.

Mr. FULLER: We are using the kindler mentioned in the report, the Le Bel kindler, without any oil or wood, and have never experienced any trouble with it. We fire up with a blower or without, using hot or cold water, as the case may be.

Mr. BUSHNELL: Our experience with oil kindlers has been very satisfactory.

Mr. HERR: It is questionable whether there is still more work for the committee. On the Northwestern road we have been using the method of kindling fires with oil extensively, but have superseded it, in a number of places, by using dirty, oily waste, and are finding that method very satisfactory as far as we have gone. It has only been in use a short time.

Mr. ATKINSON: I have had some satisfactory experience with the Le Bel kindler, using it above the coal, and have made several tests. I have also made tests with oily waste and succeeded with the blower in getting 70 lbs. of steam, in about one hour and a quarter. I made a test between two engines, one with the Le Bel and one with wood, cold water being used in each case. I found in the course of the experiment that we had to put the same amount of coal in in each case, as it was not a question of raising steam, but of getting the body of

fire ready to go in service. I put 600 lbs. of coal with 5 sticks of the Le Bel kindler in the firebox of an 8-wheel engine, 300 lbs. of coal at the beginning, and balance afterward. By the use of the blower, 70 lbs. pressure, we got first steam in 53 minutes; 70 lbs. of steam in 78 minutes; 120 lbs. of steam in 87 minutes. At that time the 600 lbs. of coal formed a body of fire about 4 in. thick on the grate, and the engine was ready for service. In the other case, the lighting with wood, we used 95 lbs. of the best dry pine, and 300 lbs. of coal to commence with, afterward putting in 200 lbs. We got first steam in 37 minutes from time of lighting, 70 lbs. of steam in 57 minutes, and 120 lbs. of steam in 69 minutes. The coal fire was then very thin, and it was found necessary to add another 100 lbs. of coal, and wait until it ignited, before the engine was fit to move out and take a train.

MR. PATTEE: The experiments, so far as we are concerned, simply show the fact that it depends entirely on location and the price of wood as compared with coal. In locations where wood is very scarce and coal is cheap something can be used to very great advantage in preference to wood. On the other hand, where wood is cheap and coal expensive, the wood was found to be better.

MR. HILL: The kindler is simply to light the coal. The cost of the oil is simply to light the fire—the same as the cost of oily waste, or wood or anything else. It does not produce the steam nor heat the water to any great extent.

MR. ATKINSON: I do not think it is ever urged that the kindler is the part that makes the steam; you must ignite a body of coal to a certain temperature.

MR. BROWN: We take it for granted that the roads using kindlers are using soft coal, which readily ignites. We are using hard coal, and I do not think we could obtain very great benefits from such a little flame in the first place. Our experience during the past 28 years has been lighting with wood in the usual way, covering it slightly with coal, and allowing it to ignite as easily as possible, so as not to increase the heat on the plates too suddenly. Previously live coals were used for starting the furnaces.

On motion the discussion was closed.

Mr. Willard A. Smith reported that the committee appointed to confer with the American Railway Association for the purpose of securing the co-operation of that Association in continuing the locomotive tests at Purdue University, had carried out its instructions, but that the conference had not resulted in any practical steps being taken to the end in view. That the Committee of the American Railway Master Mechanics' Association had fixed an assessment upon all members of 30 cents for each locomotive for companies operating more than 20 locomotives, and that subscriptions amounting to $3,000 had been received, while the sum required was $7,500. That a number of causes operated to make the amount subscribed so small. That the American Railway Association expressed its disinclination to take the matter out of the hands of the Association, and expressed its desire that this Association should go ahead with the matter. Their executive committee also suggested that the organization of this Association should be on the lines of membership of companies, represented by the officers.

The discussion of the subject was deferred until the report of the Committee on Locomotive Shop Tests.

The noon hour having arrived, the President said that questions asked by members would be considered.

FLANGED OR BLIND TIRES FOR DRIVERS.

MR. A. E. MITCHELL asked the following: "Which is safer construction for a 10-wheel engine, swinging center truck and flanged forward drivers or rigid truck and blind forward drivers?"

MR. MCKENZIE: I believe Mr. Mitchell had one of his 10-wheel engines, pulling a passenger train, with a blind tire and rigid truck in front. Running fast, it struck something and the front truck went off, the whole train following the engine. Investigation showed that there was something wrong in the construction of the engine. Had it been equipped with a flanged tire forward the engine would not have left the rail; the truck would have gone off, but the flanged tire would have held the engine to the rail. The question of the swinging motion truck and flange tire forward depends upon the wheel base of the engine. We use the blind tire forward and a rigid truck; never had any off the track on account of the blind tire, and we have had Mogul engines off the track with the flanged tire and swing motion truck. I understand they are putting flanged tires on all the 10-wheel engines; whether they are using the swinging motion truck, I am not positive.

MR. ATKINSON: With the rigid center truck and blind tires, is there much wear on the side of the truck boxes?

MR. MACKENZIE: No, sir; we do not have very much. It has been customary to put the taper outward on our blind tires; we reverse that, and put the largest part of the tire on the outside, so that the engine will go around any curve without assistance from the truck at all. I find good results from this method.

MR. ATKINSON: We built some 10-wheel engines and put swinging motion trucks in front, blind tires, and the front of the engine would swing around 4 or 5 in., heading for the fields, and we got two faces on the leading tire, considerable hot boxes and lots of trouble. I discovered what was the matter, and then stiffened up the side play of the truck by putting in side springs as well as angular suspension. It has improved matters to some extent. We decided to follow the practice of some roads, and put a rigid center truck in. I have seen 2½-in. side play on the leading truck wheels. For two years we have been gradually getting into the practice and have made it almost exclusive, putting flange tire forward with the truck as angular suspension links and side springs, with an initial compression of about a ton or a ton and a half. We can run an engine a year without getting more than a quarter of an inch wear: before, using driving flanges, the wheels were generally cut more on one side than on the other.

MR. FULLER: I understand from Mr. Mackenzie he is turning blind tires and adding a flange on both sides?

MR. MACKENZIE: We are turning blind tires. As a blind tire enters the shop, our usual practice is to turn it back about a quarter of an inch beyond the wear shown on the inside, tapering that out and keeping it the same as the other type; in other words, wearing up and bringing up another flange. I am going to stop the swinging motion truck from going from side to side. The great wear is with the Mogul engines with the swinging bottom truck. I have never been an advocate of them and never will. We use swinging motion trucks on the Mogul only. The front tires we use are 6½ in. wide.

MR. BROWN: I have been railroading for about 44 years and never saw any necessity for a blind tire. We had very little experience with the 10-wheel passenger engine until within the last 2½ years. At that time there was a great deal of discussion in the railway clubs as to the practice with rigid and swinging trucks. We put swinging bolsters and flanged wheels on one of our engines. With consolidation engines we use the blind tire, and with the first turning leave all we can on, and leave it on until the flanges are there. We give our consolidation engines more play at each end than at the center—⅞ play at back and front, main ones ⅝. With a 10-in. wheel we leave less behind—about 1/16 or $\frac{2}{16}$; $\frac{1}{16}$ on main and ⅞ on front. I do not see the necessity of the blind tire: the swinging truck is a benefit. The blind tire is on the middle driver.

MR. BLACKALL: We have about 370 locomotives. We have flanges on all the wheels, consolidations and Moguls, swinging trucks. I think we have 4 or 5 with rigid trucks and 4 or 5 with blind tires in the middle pair, but we will soon put flanges on these.

MR. BROWN: In reference to not turning tires; we have had a little experience in reference to Mogul engines coming from the builders, not put together ourselves, with the tires not turned. The builders have received them from the makers in sets, and there was a difference of ¼ and ⅜ of an inch in some of the sets. They would take one small one and one big one and pair them. We have had two or three instances where the tires have varied $\frac{5}{16}$ in. in diameter.

MR. HIGGINS: I understand the gentleman uses Krupp tires; with American tires he would not have that experience. We have one consolidation engine, with rigid wheel base, 16 ft., nothing but flanged tires on the engine, and running around curves of 20 deg. curvature. We watched carefully the wear of the flanges and find it is all right. The roadway department tells us the track is all right. We have no use for the blind tire.

MR. MANCHESTER: How does Mr. Higgings set his tire? Forward and back? There is one thing in the experience of the Baltimore & Ohio. They say they find that the tread of the rail is always worn into the tire, and therefore they read from that that a flanged iron would not be to the engine's advantage, because the rail would not touch the flange. If that is true, I do not see the value of the flanges. It is cheaper to turn blind tires than flanged tires, and I cannot see what would be gained by flanging.

MR. BLACKALL: One of our master mechanics turned off the flange on the middle pair of drivers and a locomotive went off the track. I wanted to know what the trouble was, and he said that he had foolishly turned off the flange. That has been our experience all along. We found that a flange certainly does us good. Mr. West, on the Ontario & Western, is forming flanges on all his tires. We have not a locomotive without flanges.

MR. LEWIS: Is the gage of the middle tire the same gage as the forward and back tire?

MR. BLACKALL: No, sir; we set the gage of the wheels in, ¼ in. This clears the throats of frogs and guard rails.

MR. LEWIS: What is it that keeps the engine on the track when the flange is there? The guard rail. You have a thrust on it and it will be hard to keep it in place. The only thing that can be done is what Mr. Brown has suggested—give the wheel a ⅞-in. lateral motion, and you do not get any box wear.

MR. BARNES: Is that lateral motion in the box, or between the rail and flange of the tire?

MR. BROWN: Lateral motion on the flange of the tire. We give $\frac{3}{16}$ between the box and the hub of the wheel; $\frac{3}{16}$ lateral motion. We taper the box, top and bottom, leaving about 3 in. play in the center. This allows for the engine on the elevated track.

MR. BARNES: If any one will lay down on a drawing-board curves of a radii that have been talked about—18 or 20 deg.—take 16 ft. for wheel base, making allowances for all the small clearances, three-sixteenths here and three-quarters there, and add to that the very wide increase in the gage which the trackman makes, you will find the reason why the engine goes around the curve. Recently, the spread of the gage on curves has been increased, and that makes it plain why it has been possible to use flanged tires on 10-wheel engines when it has not been possible before.

MR. BLACKALL: Going around the steamboat landing we pass a 23 deg. curve, and at Ballston a 14 deg. curve. Our engines pass around these very nicely.

MR. LEWIS: We have 10-wheel engines fitted up with the blind tire in front, and rigid truck, and we find these engines do not curve readily on a curve in excess of 15 deg. In conversation with Mr. Vauclain he mentioned that it was the practice of the Baldwin Company to put the blind tire in the middle, and he mentioned that they had a track coming out of the shops with something like a 30 deg. curve, and they had no trouble in getting the engines around the curve.

MR. VAUCLAIN: It is our practice in building 10-wheel locomotives to put the flange tire in front of the blind tire, supplying the engine with a limited swing engine truck. I do not think it is advisable to put long swinging links on the engine truck, as it makes the front end unsteady on straight line, whereas at the same time it admits the free curvature of the machine. The solution of the problem of getting a locomotive around a curve is to provide sufficient clearance for the engine to clear the space between the curve wheels of the engine wheel base in a straight line. If you have side play sufficient to allow the engine to take the position that engines formerly did when they were supplied with the Baldwin flexible truck, it does not make any difference how many flange wheels there are or how long the wheel base, she will get around the curve in some shape. We have a curve leading out of the shop that is not 30 deg. but 40 deg. It is a very sharp curve and we have no difficulty whatever in running our consolidation 10-wheel engines and all engines from that shop, around that curve, except where the locomotives are specified to have flange tires on all the wheels In a case of that kind we jack up the front end of the engine, and leave the back driving wheel to guide that end and the truck guides the forward end.

I am of the opinion that if flanged tires are desired there can be no objection to them, provided you supply sufficient side play in your locomotive to do away with heavy friction on curves. If you have a straight line to run on you can put on a rigid center truck and flange all the drivers. We have built locomotives for railroads having severe curvature with rigid center truck, and the front driving wheels flanged and main driving wheels plain. The truck boxes gave trouble, as did the front driving boxes on opposite sides, proving the engine bound tight in curves, and as there were more curves than straight lines they had trouble with hot boxes. When the engines were given limited swing trucks, and the flange driver left where it was, there was no trouble from hot boxes or anything of that sort, and little trouble from side play.

Once we built a locomotive to perform certain work upon a very heavy and long grade, with curves running up to nine degrees. When the engine was started on the curve—she was supplied with the rigid center truck and plain tires on the front drivers—she required 70 lbs. of steam to move her, with ¾ in. play on the flange wheels. We took that same locomotive and changed the tires to flange tires on the front driver and plain on middle wheel, limited swing truck, not over 1½ in. motion, short link, requiring considerable pressure to move the front end, and the engine then could be started readily at any place. It was as good as one car more on the grade.

I personally advocate the use of plain tires on the intervening wheels of a locomotive, to be made sufficiently wide to keep on the track. The track must be in bad shape, if a plain tiredriver, properly located, is going to drop in between the rails. I believe a 10-wheel engine should be supplied with a flanged tire on the front driving wheels for fear of the derailment of the truck. If the truck leaves the track the engine is sure to follow.

MR. ROTH: Since we have adopted the flanged tires on all the wheels, it has been our practice to give the boxes ⅛ in. side play, and the front and back drivers ¼ in. more play than the middle ones, and we have found good results; hardly any perceptible wear on any of the parts, flanges, etc.

MR. GORDON: I have had some experience with the 10-wheelers. We have had 10 on our road. I found on our freight engines that they were worse than on the passenger. The engines were as hard to steer as a boat and would wobble all over the rail. They cut the flanges very badly indeed. I concluded to plug the truck, using an inch pin. The engine had run about three days when the roadway department complained that the engine was knocking the curves out; but as a matter of fact the pin had broken out on the first trip. These engines continued to cut up the flange. I went to the manager and said: "We will have to do one of three things—take the engines off, put the flanged tire ahead or make a rigid truck." He did not settle the question, but said: "We shall have to stop running the engines as they are." We have a curve at one of our coaling stations, where we could not get the engine around with the swinging truck. I plugged the truck and told the engineer to come around at a faster speed, and the engine went around very freely. Since then we have had no trouble with cutting of flanges, but get a little trouble from wear in the front truck on the boxes. The engines have run nicely since we plugged the trucks.

MR. CLEAVER: I ask Mr. Roberts how much wear he would allow in his rigid engine truck with a 10-wheel engine, the blind driver in front, before he would consider it unsafe?

MR. ROBERTS: I never had any trouble in getting off the track, but all our engine truck boxes are babbitted on the side next to the wheel hub. They are cast on the core on those sides and when they get down to the bottom of the babbitt, the core being ⅝-in. deep, we turn our

boxes around and babbitt that side. We start with ⅛ in. lateral motion on each side and have had no bad results.

MR. LEWIS: I understand Mr. Mackenzie has some trouble with the Mogul engine; will he tell us what it was?

MR. MACKENZIE: The trouble was too full a wheel base. Since I have heard what has been said about flanges on the middle wheel I am satisfied that the trouble was that we did not have any flange on the middle wheel. Some years ago we got an arrangement for taking the charts of our wheels at different periods, and I never yet found a tire that showed a wear from the rail of more than 2¾ in.; a rut in the tire about 2¾ in. If that is the case, what is the use of a blind tire, what is the use of a flanged tire? We found this cutting with steel-tired wheels on our Mogul engines; it is impossible to keep them running straight. While our front tire did not suffer very much, the flanges on the truck did suffer. We have substituted the cast-iron wheel and since then have had no trouble.

MR. ROBERTS: In using 48 engines I do not think we turned the tires of one of those engines as the result of tread wear; always the result of the forward flanges cutting sharp.

On motion the meeting adjourned.

TUESDAY'S SESSION.

President Garstang called the meeting to order at 9.15 a.m.

Mr. E. L. Coster was unanimously elected associate member, and Mr. John S. McCrum honorary member.

Messrs. Mackenzie, Mitchell and Barnes were appointed the committee on resolutions.

Mr. Bardley moved that the "Proper Training of Apprentice Boys" be added to the subjects to be considered next year. This was referred to the committee on subjects for the meeting of 1897, Messrs. Mitchell, Purves and Higgins.

The report of the committee on the "Bulging of Fire-Boxes" was then read.

CAUSES OF THE BULGING OF FIREBOX SHEETS.

From the expressions and experience of the members, fairly representative in character, we are led to conclude that the principal causes of the difficulty are:

First—The accumulation of mud and scale, preventing the sheet from receiving the necessary protection of the water.

Second—Insufficient water space, impeding free circulation; and the intense heat at these points tending to drive the water from the sheet.

Third—Bad water; that is to say, in addition to the general tendency of mud and scale to accumulate, as outlined in conclusion first, water containing impurities and other hurtful substances, causing excessive foaming and a tendency of the water to leave the sheet and cause overheating of the plate.

One member of your committee, endeavoring to demonstrate whether bad water and foaming tend to cause the water to thus leave the sheets, says: "A soft lead plug (Fig. 1), which would fuse at 605 degs., was held in contact with firebox sheet by means of a spring. This

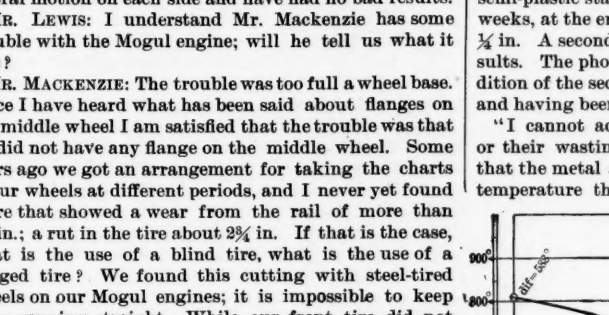


Fig. 1.

was located at a point about the middle of the firebox, fore and aft, and about 1 ft. above the grates. One of these was put in a ten-wheel engine running in Wisconsin in what we call a fairly good-water district, or water that contains about 20 grains of incrusting matter to the gallon; the other in a 16 × 24 eight-wheel engine, in service in South Dakota, where the water is bad, both n incrusting material and alkali. The one applied to the engine in Wisconsin was examined after being in place two weeks, and no change had taken place. A second examination, at the end of four weeks, showed no change. At the end of two months the plug was reduced ¼ in. in length, from the end that came in contact with firebox sheet. It had the appearance of having fused, and the point was upset, with a burr formed on the end. The

Fig. 2.

one applied to the engine in South Dakota, at the end of one week had not changed. In two weeks the plug was reduced about 1/16 in., with a burr or upset end, with the appearance of having been upset by the pressure of the spring. the metal in point of plug being at the time in a semi-plastic state. This plug was kept in this engine five weeks, at the end of which time it had reduced in length ¼ in. A second plug was put in with about the same results. The photograph herewith (Fig. 2) shows the condition of the second plug after having been in six weeks, and having been reduced ¼ in. in length.

"I cannot account for the appearance of the plugs or their wasting away, on any other hypothesis than that the metal at the point of plugs reached a higher temperature than the fusing temperature of the metal.

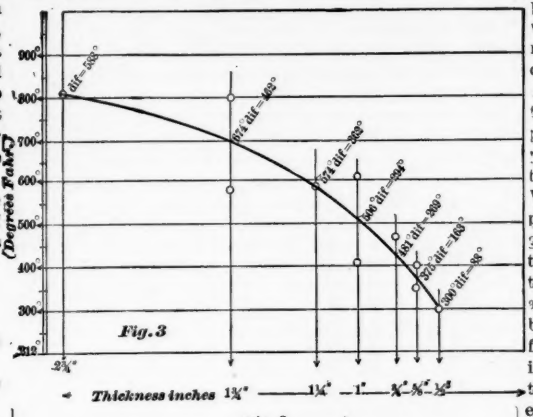


Fig. 3.

While I do not feel these experiments are conclusive, yet it leads me to believe there is something in connection with the question of the water momentarily leaving sheets, especially in bad water districts."

It is also in evidence that frequently side sheets become red-hot. The C., B. & Q. report instances of this character, and we have also heard of cases on the North Western system.

The relation between the temperature on the fire side and the water side of the plate. The experiments of the late Dr. A. C. Kirk (*London Engineering*, July 15 and Sept. 9, 1892, and Jan. 27, 1893) demonstrated this difference to be in accordance with the following diagram: (Fig. 3.)

The deterioration of the plate itself, due to increase in temperature, as shown in the experiments made by the United States Government (Watertown, 1888).

The ultimate strength of the plate increases between 200 and 600 degs. Fahr., but decreases from this point as the temperature rises, and at a temperature of 932 degs. Fahr. the tensile strength is reduced 12,000 lbs. per sq. in., or 22 per cent. (Fig. 4.)

The decrease in elastic limit, due to rise in temperature, is even more marked. The elastic limit steadily decreases from zero Fahr. upwards, and steel, having an elastic limit of 35,000 lbs. per sq. in. at zero, is reduced to 18,000 lbs. per sq. in. at 600 deg. Fahr., or 47 per cent. Then, any accumulation of scale, or if the water should momentarily leave the plate, makes the conditions still more formidable. Hirsch's experiments show that with 0.12 of an inch of scale, the temperature of the plate would be 730 degs. Fahr.; and for 0.2 of an inch scale, 1,000 degs. Fahr. (steam pressure in both cases being 180 lbs. per sq. in.) (Note the dangerous blue-heat point is between 600 and 700 degs. Fahr.)

The general practice of the country is to have the stay-bolts as close together as practicable, spaced about 4½ in., and it would hardly do to add intermediate stay-bolts, although one member, located in a particulary trying district, says: "I have noticed that side sheets bulged more along the fire line than anywhere else, especially after any scale is formed; it is our practice to put in additional stays in side sheets along the fire line."

A few cases have been cited by the members where oil was given as the cause of bulging, notably in new boilers or when new sheets had been applied and the engines not immediately put in service, and when fired up the bulging has been noticed.

As to remedies we quote one of our members, whose location and experience is fairly representative of the best and worst natural conditions to be met with in our country, as follows:

"Our remedy is on the line of separating the lime from the water by precipitation induced by chemical action in the tender or boiler, and the mud so formed blown or washed out before the same shall have formed banks and baked into the sheets. The tank is provided with a receptacle into which the chemical is placed; preferably a 4-in. pipe fastened to top of tank by a flange, the pipe being 2 ft. long, perforated at the bottom and extending into the tank its entire length; the top protected by a cover. The chemicals are applied in granular form. A sufficient quantity of the chemical, to take care of the water in making the contemplated run over the division, is applied at the roundhouse. Our reasons for thus applying, instead of a prescribed amount with each tank of water taken, is that in practice it has not been found necessary to do so. The quantity of the chemical necessary can best be determined by frequent and careful inspection of the side sheets, stay-bolts, flues and all interior parts of the boiler, and where no scale is adhering to any of the parts the desired results are being obtained. After the precipitation of the lime, in the form of mud, it is then treated as any muddy water, by blowing or washing out. We consider it good practice to allow engine, after completion of run, to stand, say, ten or fifteen minutes before going to the house. This allows the mud (which, while the engine is working, has become thoroughly mixed through the water) time to settle to the bottom of boiler and leg of firebox. Both injectors are then put on and blow-off cock opened until muddy water ceases to come from it, which usually amounts to the lowering of water in boiler two or three gages. Our reason for selecting this time for blowing off, is that it is the only time the engine can be held the necessary time for the mud to settle without delay to traffic, and if done after the engine had been at rest several hours the mud or deposit would have become solid."

"In order that the best results may be obtained by chemical treatment of the water, thorough boiler washing is necessary. The mud, precipitated by chemical action, can easily be removed if reached by a stream of water When the service will admit, the boilers should stand until steam is down before water is let out, and warm water used for washing and filling boiler. A water pressure from 75 to 100 lbs. is desirable, and when the water contains, say, 20 grains of incrusting and about the same quantity of non-incrusting matter per gallon, the boiler should be washed about every 1,000 miles, and more frequently, proportionately, if the water is bad. The leg of boiler should be provided with handhole plates or plugs, just above the mud ring at each corner. The front flue should have wash-out plugs—one on each side of exhaust pipe near bottom, also two or more near central part of boiler—so distributed that best results may be obtained in reaching all flues with a stream of water; the firebox flue sheet to be left blank opposite each plug hole in front sheet; three plug holes in boiler head, just above crown-sheet level, so distributed as to avoid crown bolts and braces, and reach all portions of

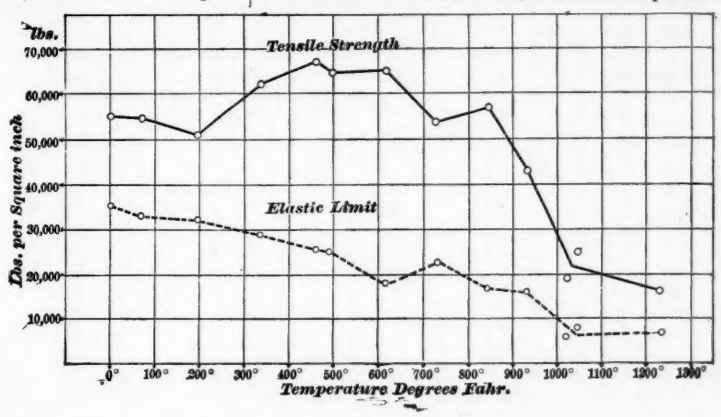


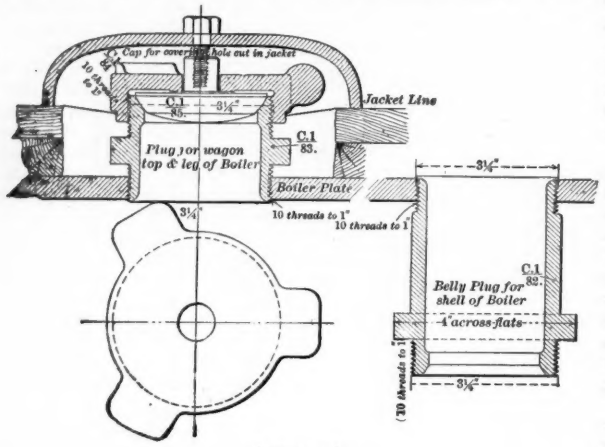
Fig. 4.

crown sheet with a stream of water. Fig. 5 shows design of wash-out pipes and nozzles. Pipe *D* is used from front end and should be long enough to meet firebox flue sheet, the connection to hose to be flexible, so that pipe can be revolved as it is moved in and out between the flues. With judiciously located wash-out holes, the desired water pressure and intelligent handling of the pipes or nozzles, all the mud lodging among flues should be reached and dislodged.

"Pipe *A* is for crown-sheet washing. In length it is intended to reach full length of crown-sheet; the connection to hose to be flexible, as described. The opening for nozzle at right angles to pipe is to provide for the sediment moved from the crown sheet being carried over the sides of the firebox, instead of on top of flues. Pipes *B* and *C* are for washing over furnace door, around leg of boiler and brick arch tubes."

Mr. F. W. Johnstone, of the Mexican Central Railway, submits a form of wash-out plug, shown in Figs. 6 and 7, concerning which he says: "This plug remains permanently in the boiler, so that there is no danger of the threads being crossed, as is the case with the ordinary tapering plug. With the old-style taper plug screwed into the sheet, the end of the plug often reaches into the water space, scale accumulates on the end of the plug, and when it is unscrewed it tears the thread out of the boiler sheet. To prevent leakage, boiler washers often use white lead, and after the plug has remained in the boiler for some time the white lead becomes set. This also has a tendency to destroy the thread, both in the boiler and in the plug."

Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific, says concerning the Rushforth feed-water heater, which has been used on his road with a great variety of water, some containing as much as 136 grains of solid matter to the gallon: "Numerous experiments have been made to neutralize the bad water, using boiler compounds, zinc castings hung in the leg of the boiler, etc. This zinc has been entirely destroyed by the action of the water in running 600 miles. It softens the scale, but does not prevent foaming. A combination of soda and lime was found to nuetralize to a certain extent the scale producing properties of the water. The Rushforth feed-water heater has given the best results, 50 being now in successful operation. On



Figs. 6 and 7.

one division the necessity for washing the boilers after a trip of 137 miles was changed so that a run of 30 days was made possible by the use of the above-mentioned heater. A run of 72 days is recorded without changing the water in the boiler. The engines steam freer and carry water well on the hills and do not foam. By this plan we have also been enabled to open up the nozzles ¼ in. Our engines are equipped with four blow-off cocks, one in the cylinder part of the boiler behind the front flue sheet, one in front of the leg and one at each back corner of the leg. They are equipped with air-valves. All connections are fastened to the boiler head and operated by the engineer or fireman the same way as

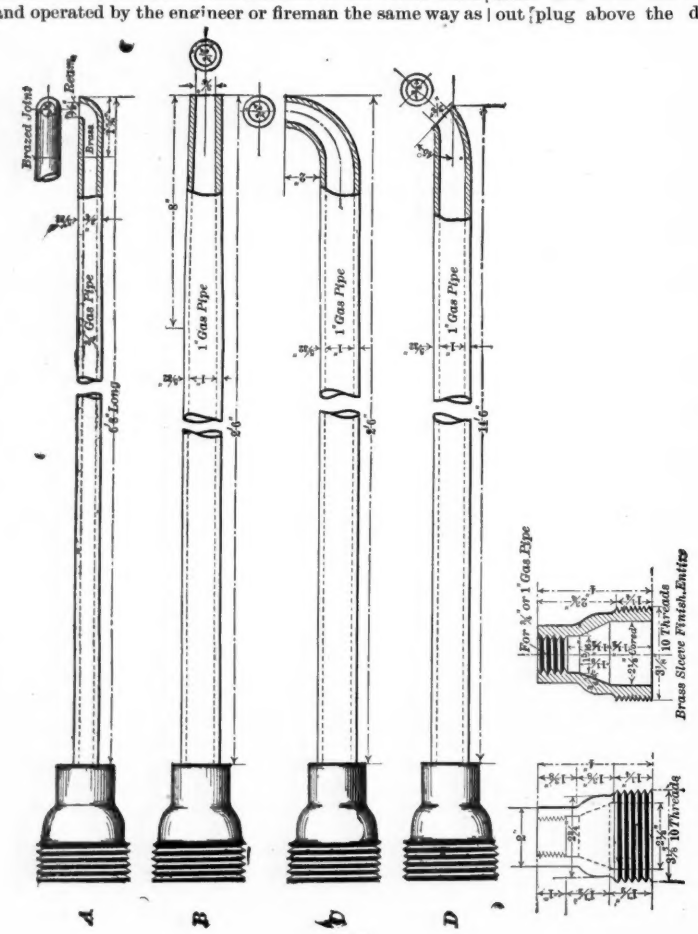


Fig. 5.

the engineer's valve. Our engines are blown out at each end of each division, and also once or twice in going over the division. The saving of time otherwise used in washout boilers has been very marked. On one district using an average quality of water 20,000 miles has been run without washing the boiler, no mud or scale being then found in either leg of the boiler or the cylinder part. The plan has certainly been the best ever tried here for handling bad water.

Mr. Sprague moved that the report be received and the committee discharged. (Carried.)

MR. SPRAGUE: The practice of increasing the space from the bottom of the ring up to the top of the boiler is spoken of as if it were incidental; it has been my practice in small locomotive boilers for the past twenty years.

MR. MITCHELL: I consider the water nozzles shown in the report to be very effective devices. I saw them in use in Chicago recently, and was told they were patented; it looks as if we were advertising a patented device.

MR. MANCHESTER: We have designed and put those nozzles into use on the C., M. & St. P., and there is no patent on them.

MR. LEEDS: I have used these nozzles for the past 35 years continuously, and I think the patent is run out.

MR. MACKENZIE: We have been using them for 10 years with a better arrangement. When we remove the washing plug from the head of the boiler, we have another plug that screws into it, and a pipe is made to run in and out of this plug, so that the men are not knocking the nozzle to pieces. It is made to turn and this hole is cut to slant so as to throw the water at an angle of 35 deg.

MR. GALBRAITH: The committee does not give us any information that the device consisting of a sheet placed between the firebox side sheet and external sheet to promote circulation, has been extensively used. The Union Pacific built 12 locomotives in 1875, equipped with this device, and it was tried where the water was exceedingly bad. One of them ran six weeks, when both side sheets cracked from the top corner diagonally to the bottom one. Two more remained in service about five or six months.

MR. HATSWELL: We use a force pump in washing our boilers and have but little trouble with cracked sheets unless there is a large accumulation of mud and scale. We wash out our engines at every 1,000 or 1,500 miles.

MR. MACKENZIE: In 1874 a foreman boiler maker on the Hannibal & St. Joseph road had a patent on this circulating device. It consisted of an inner shell to the boiler, forming nothing more or less than a double boiler. There were three engines equipped with it; but in four months new fireboxes were necessary.

MR. MCCONNELL: On some districts we put in washout plugs just about the line of crown sheets between every other bar, also on the back end of the butt sheet and over the furnace door. We put a washout plug above the door and it has done much to prevent the door sheet cracking. The greatest advantage we have is by use of the heater. We have found by a comparison of engines with the heater and without it, that there is a difference of about $16 a month in the cost of coal consumed in favor of the former. The water enters the boiler at 620 degs., and the solid matter that is held in suspension is deposited in the form of mud which is readily blown out at the end of the division, or when we take water at the tanks.

MR. HERR: The committee stated that in connection with this heater four blow-off cocks are used at intervals on the trip as well as at both ends of the line. I would like to know if they have been used without the heater.

MR. MCCONNELL: They have not.

MR. GIBBS: If we are to draw any conclusions from the experiments of the committee as to the cause of bulging of sheets, that conclusion would condemn this recommendation of a member to use the circulating device between the side sheet and outside sheet. This would restrict the circulation more than it is at present. I am satisfied that at times the water leaves the side sheet long enough for the sheet to get hot enough to melt lead and probably red hot. If that is the case it is due to an explosive action, and a contraction in the water space would increase this. A short time ago we equipped a boiler with zinc plates to stop corrosion, and after a few weeks we found the zinc loose in the bottom of the boiler, in the shape of powdered, spongy metal. It was puzzling to know how it occurred until we looked up the physical characteristics of the metal. This was due to the fact that at a temperature of 340 degs. the metal becomes brittle and crumbly. We were obliged to give up the use of zinc for that reason.

MR. MCCONNELL: Our experience with zinc was that the casting was destroyed in about two trips over the road, retaining its form, but being very brittle. Only here and there a crystal of the zinc was found, the action of the water having destroyed it. We found that while in some instances it would soften the scale, it would make the engines foam.

MR. MANCHESTER: On the St. Paul system we have had a number of mechanical purifying devices; and taking them as a whole, the results have been bad.

MR. FORSYTH: The discussion shows that the principal cause of bulging is from scale or mud, and bad water. I do not think the second cause given, "insufficient water space," is necessary. I have seen side sheets 10 or 12 years old perfectly straight. The reason why there is very little difference between a narrow and a wide water space is that with a small accumulation of scale on the side sheet and an intense firing on the other side, the interference of the scale prevents the transmission of heat through the sheet and the water is driven away from it, whether the space is three inches or a foot wide. I question whether the committee is justified in giving this as one of the principal causes. I think it is due to scale and mud, a thin hard scale producing bulging in the same manner as a lamination in the sheet by interfering with the transmission of heat.

The Rushforth feed water heater is recommended, but it may be regarded as a series of blow-off cocks. The amount of heating surface in that heater is not one-tenth that of an ordinary stationary one, and there is no chance whatever for it to operate as a genuine feed water heater.

MR. LEEDS: I think that a contracted water space has a strong influence. The steam bubbles must have room to rise, and the cold or the solid water must have space to descend to take the place of the evaporated water. If this space is so small that there is a friction between the two, there is a greater chance for leaving the side sheets bare. We have had strong evidence of that. We contend that if there is an overheating of the sheet, whether by the water leaving it or by insufficient space for the steam to rise and the water to take its place, there is going to be bulging the same as we have noted on the crown sheets. I think we have evidence that a mechanical feed water heater could be constructed that would remove the scale, the only question being about the proper proportions. If we could only introduce a heater that would take live steam and raise the temperature to an extent that would precipitate the sulphates, we would have a useful purifier.

MR. BARNES: The mechanical feed water heater is known to be a success; but a locomotive is about a 1,000 H. P. machine, and a satisfactory mechanical feed water heater and purifier, made on the plan of the most practical heaters used in stationary boiler practice, would have to be larger than the locomotive boiler. It cannot be made to operate with satisfaction if it is much smaller. The water must first be heated to a temperature near the boiling point, and then allowed to stand until the impurities fall out. In a locomotive boiler running on the road, about a barrel of water is used per minute, and it would probably take 15 minutes for the impurities to settle.

In regard to the circulating device spoken of, I think there is a misapprehension about the direction of the flow of water in locomotive boilers. The water is supplied by the injectors into the forward end of the shell, and descending, circulates backward to the bottom of the fire-box leg and rises upward. Anything put in the way of the raising of the water would interfere with the circulation. It is practically impossible to get anything to descend in the water leg, as all the water there is going up. There may be several causes of the water leaving the sheet. Those who have boiled water in glass vessels know that if the vessel is contracted like a tube, and the bubble big enough, it will force the water ahead out of the tube. The smaller the tube the quicker this action will take place. By putting in this sheet you would induce the same action. If the sheet is hot the water will form into steam so rapidly that very little of the sheet will be in contact with the water. The secret of the success of the Rushforth water heater, as has been said here, is in the blow-off cocks. In modern practice they keep the boiler free from incrustations by blowing it off, and if it is blown off frequently, I think there will be no trouble. When the fire gets in unusually good condition near the sheet, what is known as "blow pipe" action takes place and the sheet is overheated. You can put a blow pipe against a sheet, drive the water from it and make it red hot. That will take place with a fire of good soft coal, when the draught is concentrated in the proper way. It is not the object of this report, as I understand it, to show that sheets will bulge when the scale is on, but the question is, why do they bulge when there is no scale, which is the experience of a good many people? This question frequently comes up; and it may be due to the fact that we have got the fires in locomotive boilers so hot that there will be times when the water will not stay against the sheet.

MR. VAUCLAIN: Mr. Barnes' point in regard to the temperature of the fire is well taken. In locomotives where the fireboxes are much contracted, we have more trouble with side sheets overheating and bulging than in fireboxes where the grate surface is large. The grate surface should be increased to keep down the rate of combustion for bituminous coal at least to 125 to 140 lbs. per square foot of grate surface per hour. In many cases it runs as high as 250 to 260 lbs. The contracted grate also reduces the percentage of direct heating surfaces in the boiler. Very wide fireboxes of the Wooten type are long lived as compared with the narrow contracted fireboxes burning bituminous coal, there is no

other reason for it than the slower rate of combustion, and less intensified heat at that point. There is another reason why the narrow contracted box would give more trouble. It is in the circulation of the water which Mr. Barnes has described. To have the full benefit of a feed-water heater to remove incrusting matter, it would be necessary to have one built upon scientific principles. In some locomotives we have an evaporation of 65 gals. of water a minute, and one hour's run will nearly empty a 3,800 gal. tank. To provide a feed water sufficiently large to take care of that would require a 60,000 lb. car to carry the apparatus on.

Mr. GIBBS: Our discussion seems to have concluded that the cause of bulging is overheating. If it is so, it shows that we are running our fireboxes red hot part of the time, and that we are pretty near the danger line.

Mr. LEWIS: I think an important point is the inequality of the temperature of the firebox sheets when firing up. The effect of the higher temperature of the fire than the water would be to elongate the firebox surfaces of the sheet, while the sheet in contact with the water would remain in its normal state. That elongation of the sheet next to the fire is bound to produce the effect of bulging. Too much care cannot be exercised in firing up an engine. It has been our practice always to blow the water out of the boiler before it became cold, when the engine was going to the roundhouse. We fill the boiler with warm water just before firing up. We never fill it until just before firing, and have improved the life of the side sheets materially by this practice.

MR. GIBBS: Why does the bulging take place in a certain zone of the fire—the temperature above and below the place is about the same?

MR. LEWIS: I think the greatest bulging takes place at the fire line, where the heat is most intense, caused by the flames impinging at that point. I do not assume that the heat is uniform throughout the entire box.

MR. HERR: I question whether the sheets are bulged when the engine is fired up. We know that the water is colder then than it is when the engine is in service, but we also know the fire is much less severe. Whether it is the scale that produces this bulging or whether the water space should be widened are the points to be considered. I have known engines to have bulging side sheets above the fire lines whose sheets were entirely clean. It is an important matter to consider whether we need any more space in the water leg.

MR. LEEDS: In firing up, although the temperature is a great deal lower in the aggregate, the variation between the inside and outside at that time may be greater than it is when the fire is most intense. I am firmly of the opinion that scale has little to do with the bulging of firebox sheets.

MR. HIGGINS: I agree with the gentlemen in regard to the formation of scale having very little to do with the bulging of side sheets. The road I am connected with has adopted the Wooten type of firebox. Our master mechanics tell me they never have any bulging of side sheets in our boilers with the Wooten type of firebox, even in districts where the water is bad. They are washed out at least once in every 10 days.

MR. MACKENZIE: I have seen water introduced into the boiler when the throttle was closed and blower shut off, causing no decrease of steam pressure until the throttle was opened, when the gage would go back 25 lbs. I know this will cause the flues to leak and think it also will cause the side sheets to bulge. It is simply the dormant position of the water. The moment the circulation is affected by the drawing off of the steam, the cold mass of water strikes the hot sheets and the damage commences.

MR. RETTEW: My experience is that bulging occurs from 15 to 18 in. above the bottom, and in every instance I have found a broken stay-bolt. My belief is that the bulging is caused by broken stay-bolts.

MR. SOULE: I gather from the discussion and report that there are four principal causes which result in bulging fire-boxes; concentrated action of the fire; insufficient width of the water space; formation of scale on the sheets; accumulation of mud in the leg. Mr. Vauclain has suggested as the best remedy that we enlarge our fireboxes. As regards the width of the water leg, in most cases it cannot be widened out without reducing our grate area, which would be an evil in the other direction. What we need is to have powerful pumps in every roundhouse. We can then wash the boilers thoroughly and frequently, throwing into them a large volume of water at high pressure. This may be supplemented by the use of nozzles of various forms and shapes.

MR. MILLER: Some years ago we had trouble with the cracking and bulging of side sheets, and also of crown sheets In a good many instances this took place immediately after the boilers were washed out with cold water. We now wash our boilers out with hot water, and since the introduction of that system we have scarcely been troubled with a cracked side sheet. We use a pump with pressure of 120 lbs. when it is necessary. I always found where there was a crack it came in the narrow space. Two years ago we increased the water space to 5 in. in the front and 4 in. on the sides and back. The boilers since have proved entirely satisfactory.

MR. MILLER: There are many causes, but the fact will remain that bulged firebox sheets are caused in the majority of cases by mud or broken stay-bolts, which weaken the sides and allow the sheets to bulge.

The report of the Committee on "Best Material and Specification for Locomotive Tubes" was then read.

MATERIAL AND SPECIFICATIONS FOR LOCOMOTIVE BOILER TUBES.

The committee finds that iron is recommended in all the replies to its circular as best for locomotive tubes. Steel tubes are more liable to hit, and where water is bad they are hard to keep tight. The ends become hardened from rolling and calking and break off at the firebox end. Some trouble is reported from imperfect welds in the use of steel safe ends, the melting point of steel being lower than that of iron. Steel safe ends may be perfectly welded to steel tubes and iron ends to iron tubes, but imperfect welds result from the use of the two materials together. The committee recommends knobbled hammered charcoal iron tubes, and describes the process of making this iron.

In preparing specifications and tests the committee considered tensile strength and elongation, but after considerable correspondence decided that such a use would be of little importance. The tests recommended are all very simple, and adopted after careful consideration and consultation with members of the association and tube makers, the latter saying there will be no difficulty in making tubes to comply.

It is deemed best to give the limit of weight in pound to the foot for the different diameters and gages, to prevent the acceptance of tubes rolled lighter than the gage ordered.

The physical tests are given to show the quality of the material. Inferior tubes have been made with a layer of good iron on the outside and common iron inside. This fault cannot be detected by the tests of cutting off a section and hammering it down endwise, which has led the committee to suggest that better results may be obtained by planing strips lengthwise from the tubes and turning over the ends in opposite directions, testing inside and outside layers.

As to the pin test, it has been demonstrated that no tube of common iron will stand this test. Directions for making an etching test are also given. The specifications and tests, not precisely as recommended by the committee, but as modified and adopted after discussion, are given below.

SPECIFICATIONS AND TESTS FOR IRON LOCOMOTIVE BOILER TUBES OF BEST QUALITY.

MATERIAL.

Tubes to be made of knobbled hammered charcoal iron and lap welded.

DIMENSIONS AND WEIGHTS.

Tubes 2 in., outside diameter.

No. 13 B. W. G.	shall weigh at least	1.91	pounds per foot.			
No. 12 B. W. G.	"	"	"	2.17	"	"
No. 11 B. W. G.	"	"	"	2.38	"	"
No. 10 B. W. G.	"	"	"	2.64	"	"

Tubes 2¼ in., outside diameter.

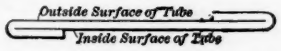
No. 13 B. W. G.	shall weigh at least	2.16	pounds per foot.			
No. 12 B. W. G.	"	"	"	2.46	"	"
No. 11 B. W. G.	"	"	"	2.70	"	"
No. 10 B. W. G.	"	"	"	2.99	"	"

SURFACE INSPECTION.

Tubes must have a smooth surface, free from all laminations, cracks, blisters, pits and imperfect welds. They must also be free from bends, kinks and buckles—signs of unequal contraction in cooling or injury in manipulation—and must be of uniform thickness throughout, except at weld, where one gage number additional thickness will be allowed, perfectly round and cut to exact length ordered.

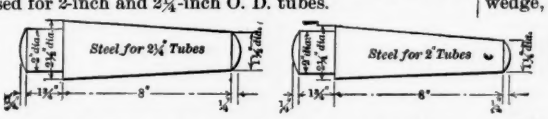
PHYSICAL TESTS.

1. Strips ½ in. in width by 6 in. in length, planed lengthwise from tubes, after being heated to a cherry red and dipped in water at 80 degs. Fahr., shall bend in opposite directions at each end, as shown in sketch below, without showing cracks or flaws; and when nicked and broken these must show a fracture wholly fibrous.



2. Sections of tubes 12 in. long—5 in. of which shall be heated to a *bright cherry red* in daylight—when placed in a vertical position, and a smooth-turned tapered steel pin at a *b ue heat* is driven in, by "lap" blows with a 10-lb. sledge hammer, must stretch to 1⅛ times their original diameter without split or crack. One tube to be tested, as required in paragraphs 1 and 2, in each lot of 250 tubes or less.

The sketches below show dimensions of steel pins to be used for 2-inch and 2¼-inch O. D. tubes.



3. Tubes must expand, turn over tube plate and bend down, without flaw, crack or opening at weld.

HYDRAULIC TEST.

Each tube must be subjected, by the manufacturer, to an internal pressure of 500 lbs. to the square inch.

ETCHING TESTS.

In case of doubt as to the quality of material, the following test shall be used, viz.:

A section of pipe turned or ground to a perfectly true surface, polished with fine emery paper, and free from dirt and grease, to be suspended in a bath of

Water	9 parts.
Sulphuric acid	3 "
Muriatic "	1 "

The bath should be prepared by placing the water in a porcelain dish, adding the sulphuric acid and then the muriatic acid. Chemical action is allowed to continue until the soft parts are sufficiently dissolved so that an iron tube will show a more or less finely-ridged surface, with the weld very distinct.

GENERAL REQUIREMENTS.

Each tube must be plainly stenciled "knobbled hammered charcoal iron" and "tested to 500 lbs.," and tubes must be so invoiced. Each tube must also be subjected to careful surface inspection, as provided for above, and those measuring ¼ in. over or under the diameter ordered shall be rejected.

Failure of a single tube to pass any of these tests shall be cause for the rejection of the entire order.

MR. GIBBS: I have made a close study of this specification for boiler tubes. We have had a set of boiler tube specifications in use for a good many years which does not differ materially in some of the items from the one proposed. I think it is a cheaper one to make for a railroad that has a testing machine, and it distinguishes between two grades of tubes—a body grade and safe end grade. The committee report that the hammering test of the tube section is objectionable, as not showing the quality of the inside layer of the tube. This is true and in addition, it is a much easier test than the crushing test, made in a testing machine. This, I believe, shows particularly the quality of the tube. The physical test of cutting a strip out is expensive, and, unless the strip is prepared carefully and of uniform width, I do not believe it will be of much value. The etching test we consider of great value.

MR. LAWES: The committee desired to voice the experience of the members of the Association, and for that purpose they issued a circular asking if it was practicable to use a fair grade body tube with a first-class quality of safe end. The replies were of such a nature that the committee did not advise the use of two grades of material for locomotive boiler tubes.

MR. MCCONNELL: In some portions of the country the flues remain in 10 years, but west of the Missouri River the flues do not remain in the boiler more than 10 months. A good grade of charcoal iron tubes would answer the purpose as well in these boilers. It is customary on some divisions in the Western country for the flues to be removed once every six months, and an expensive tube such as would come up to these specifications is not necessary. The recommendation of the committee which might do for the Eastern portion of the country will not do for the Western, where the water is bad and the flues cannot remain in the boiler.

MR. LAWES: The committee has not taken into consideration the cost of the tubes. The committe was appointed to report on the best material, and the prices quoted for these various tubes was not to be considered.

MR. ROBERTS: If we adopt this report it still leaves the master mechanics to make requisition for such quality of tubes as they require. What we want is to get a tube that will stand the wear, and a tube that can be applied and worked easily. When it comes to a question of labor in the application, and not a question of the action of water on flues, I think the high grade flue is an economical one.

MR. BARNES: I do not see why this specification could not be adopted. We have one for boiler material which we adopted last year on trial. I do not see why we cannot go ahead on that basis with this.

MR. GARSTANG: I think the committee have labored and done well. If we adopt this as a standard, it does not mean that members are obliged to use this particular kind of tube; but if he wants a first-class tube he has something to guide him in purchasing that tube. Until this report was made, we never had a specification that would answer.

MR. VAUCLAIN: What we want is a specification for boiler tubes of good quality, and com etition will regulate the price. As we have had such happy results with the specification for boiler plates, it seems to me that this Association is not going to make a mistake by adopting this report as their standard, and if they do make a mistake it is on the right side.

On motion of Mr. Barnes, the title of the specification was made to read "Specifications for Iron Locomotive Boiler Tubes of Extra Quality."

DRIVING BOX WEDGES.

The noon hour having arrived, the topical discussion was on the question "Is the Use of the Adjustable Driving-box Wedge a Necessity."

MR. HERR: I think the question, "Is the use of the adjustable wedge a necessity?" is a live one. I have had no experience in using engines without an adjustable wedge, but have been seriously considering doing so.

MR. CHILDS: Last October we fitted up one of our engines with stationary wedges by taking the centers, planing them up and removing the pedestal brass. The box was fitted snugly to the wedges before applying to the journals. That engine has been in service ever since, and we now have 25 similarly equipped We are getting excellent service from them, never having had a hot box. In the Mogul engines we find little wear in the No. 1 driving-wheels, and it has not been necessary to line them up, but with the main back drivers it has been. The engines have been in service nine months, and the first one has been lined twice since that time. I do not think it advisable to put in ordinary sheet tin, as it has a tendency to work out at the top. We let them go until we place in a Russian iron flange.

MR. LAWS: What do you do when the driving-box sticks? Is it not easier to let down the wedge to prevent that sticking than to let down the pedestal brace?

MR. MITCHELL: I do not believe we are going to have the boxes sticking. We thought the boxes might stick, and therefore went very slow. I believe the adjustable wedge will cause this more than the stationary wedge.

MR. LEWIS: We took up this question some two years ago, and since that time I have equipped a number of engines engaged in all kinds of service. We have experienced no trouble. It is true we have an advantage over

some types of engines in having a thimble binder. In the event of a stuck wedge we can loosen up the binder bolt and relieve it. In practice it has not been necessary to do so. We have run these engines some 8 or 9 months, but no relining has been necessary. I think the trouble with the movable wedge is that engineers do not use the best judgment in adjusting them.

MR. MITCHELL: The engineers are asking us to put in stationary wedges. I think we can say they are a success.

MR. BRIGGS: We have experienced a great deal of trouble with our rods, and in nine of ten cases we have found it was due to the engineers not taking care of the wedges properly.

MR. FORSYTH: We had a great deal of trouble with loose wedges and loose wedge bolts. We have made experiments in this matter during the last three years. Our master mechanic is so pleased with the fixed wedges that he has recommended them for the whole road. It has been adopted as a general practice on our road; and all our repair shop work is done with fixed wedges.

MR. SETCHEL: One reason assigned was that on account of the injudicious way in which wedges are sometimes set, the crank pins and axles are put to undue strain and are broken. That seems to be a very good reason, but nothing has been mentioned outside of that as to the economy in construction and durability in keeping the engine up.

MR. FORSYTH: There would be a slight difference in fixed cost, in favor of the wedge. It does away with the wedge bolts and with the work in preparing the taper. It is evident that when our master mechanics are unanimously in favor of a radical change of that kind they must have some very good reasons for it.

MR LEWIS: I think the members will admit that a very large percentage of round-house repairs is from broken wedge bolts and the saving in that item alone would justify the adoption of the stationary wedge.

COMPOUND LOCOMOTIVES.

The subject "Has the Experience of the Year Advanced the Interest in Compound Locomotives" was announced.

The Secretary gave a general statement of the comparative merits of the compound and simple engines, and referred to some comparisons which he made between compounds in England, Germany and France.

MR. GARSTANG: We have 60 10-wheel locomotives of exactly the same design, weighing 136,000 lbs., and having 19 × 24 cylinders. Among them is a compound which we have run with the simple engines, month in and month out. The figures of the performance of the compound show a saving of 22.9 in fuel over the simple engines of the same type. The cost of maintenance of the compound was less, but that is easily accounted for, as more of the simple engines passed through the shop.

MR. GIBBS: I am convinced that the compound is the coming locomotive for freight service. The compound engine offers the most universal means of accomplishing a fuel economy of 15 per cent. We have had one compound for four or five years, and ascertained the economy on an elaborate test of the engine. It is still showing that economy. I find from a record of two years' performance there has been spent an average of about 2½ cents a hundred miles for repairs, as against 4⅞ cents for the other engines of the same class. This is about a thousand dollars a year less. It is easy to make 10 per cent. difference in the coal economy, which amounts to a saving of $500 a year in fuel.

MR. BARNES: As the subject is the improvements and discoveries with reference to compound locomotives during the past year, I think we might say a little about it. We started out with two-cylinder compounds with numerous automatic devices. The result of experience has been to take those off, until now the engines are almost universally made, here and in Europe, with an independent exhaust. You absolutely cannot handle an engine properly without having an independent exhaust of the high-pressure cylinder. The experience of marine work has been studied with profit. The advocates of compound locomotives ought to be careful about the extravagant claims set forth as to their performances. The limit of efficiency of a compound engine, if non-condensing, could not be much lower than 22 lbs. of water per horse-power hour. In a recent paper read before the American Society of Mechanical Engineers 18½ was claimed. Another man claimed 17½, but he did not give all the facts. He measured his 17½ from the indicator card, while the true consumption was probably 24, quite another matter. Some discoveries relative to indicator cards, resulting from tests on compound engines, have been made. We find that with a long pipe you can make an engine show 1,000 H. P. when it really has only 800 H. P. If there is any difficulty in the way of the further introduction of the compound locomotive it is the matter of the weight of the reciprocating parts. Railroad superintendents are becoming exercised by the damage to track from locomotives, because of excess balance. For high speeds where the wheels are not very large, it may be that we will have to stick to simple engines for this reason alone. In England the compound has been abandoned, while in Germany and other countries where the railroads are under the control of the government, and haul their trains more economically, the compound is on the increase. One of the causes of reported failures of compounds is to be found in the fact that they are not always adapted to the work they are called upon to do.

MR. VAUCLAIN: The use of compound locomotives has given to railroad companies in the United States a means of reducing their operating expenses to a greater extent than any other item of improvement connected with the operation of locomotives. We have had several examples lately of how energetically the companies proceed in the methods of saving oil. If the railroad companies would proceed as energetically in the direction of perfecting the compound in saving fuel, the amount saved would have a greater bearing upon the cost of operating their locomotives. If we turn to Europe, where they have been using compound locomotives for a much longer period than we have, we will find that on the whole compounds are making great headway. In Russia almost all the locomotives for freight service, and a large number of those for passenger service, are compound locomotives, built under various plans and designs. In Germany the two-cylinder compound has made much headway. In France, where the four cylinder is used almost exclusively, and to which Mr. Sinclair referred as complicated engines, we must not lose sight of the fact that all French locomotives are complicated, and no doubt they fully realize all the saving it is possible to realize with compound locomotives.

We have had compound locomotives running for over five years, and in following up some of the first compounds we find that about the same economy is effected at the present time as was effected when the engines first went into service. The engines we are building to-day are superior to the engines built then. It is very natural they should be. We have been able to find out and locate the worst strains and provide against the rupturing of parts. Up to the present time we have not been under the necessity of removing the compound cylinders of a single locomotive, but we have furnished compound cylinders for a number of single expansion locomotives. We have been called upon to build complex engines, which are used for heavy mountain grades. We are building at the present time a locomotive with compound cylinders to work one engine and single expansion cylinders to work the other. We have come to the conclusion that on a number of the high-speed passenger trains in use in this country the engines are too heavy for the work, and it is simply a question of boiler capacity and not adhesion. We took a 6½-foot driver engine, removed the side rods, balanced up the wheels accurately and operated the locomotive for six months as a single driver engine, similar to hundreds of such engines as are in use in England, and had very excellent results. All through the very coldest weather last winter, through the blizzard, this engine came in and went out as nicely as any other. The performance was so satisfactory that we are to-day building a compound single driver locomotive with 7-foot driver wheels, with the same heating surface, and 2 in. more stroke to the compound cylinders. The reason of this is that we found for high speed service the single expansion engine is needed to a certain point. After that point is reached, you must get back to compound cylinders in order to increase the efficiency of your boiler, and get advantage of the 15 or 20 per cent. you are able to save in the consuption of water.

MR. DAVIS: The compound locomotive is without question in my mind the locomotive of the future, but its progress would be much more rapid if the advocates of the compound were more moderate in their claims. The principle of using steam by double expansion instead of simple cylinders is so well understood and so well appreciated by engineers, that it seems hardly necessary to say anything further on this part of the subject. The object of every design of a compound locomotive should be to keep the mechanism in its simplest form, using as few working parts as possible and having as much of the engine similar to the simple engine as can be. Some of the later types of two cylinder compounds have been doing such uniformly good service that it looks really as if the compound engine of the future had arrived.

MR. MITCHELL: We have on the extreme westerly end of our road eight 10-wheel Baldwin compounds with 62-in. drivers. They have been in service two years on fast and slow trains, mostly fast freight trains, and have given excellent results. They save from 8 to 10 per cent. in coal and about 15 per cent. in water. The water is more important, as the incrustation of the water with us is very great. With the simple type we only get 8 to 10 months service out of the flues, but with the compound 12 to 14 months.

MR. GARSTANG: Our experience with the flues is similar to that of Mr. Mitchell. We have run the flues in our compound engine between four and five months longer than was ever known before in the same service. We are so favorably impressed that we are going to replace the 19×24 in. cylinders on one of our simple engines, with a 20-in. high-pressure cylinder and 32-in. low pressure.

MR. HERR: I believe that the compound engine, especially in freight service, gives us an opportunity of a very considerable saving in coal, but I do not believe that all the saving can be fairly attributed to the compound principle.

MR. WEIGHTMAN (Pittsburgh Locomotive Works): I think those who have followed closely what may be termed the rise and fall of the compound locomotive, have not failed to conclude that there is a very substantial saving to be made, provided the engine can be made to remain upon alignment and render as good service as the simple engine. The use of more than two cylinders and all automatic devices on any locomotive mean expense and delay. I have had about three years' experience with a two-cylinder compound, upon which no changes whatever have been made. It has a plain intercepting valve, non-automatic, and in no case has the engine ever failed to respond when called upon, and in no case has it ever failed to outpull any engine of its weight that it has been matched with.

The report of the committee on standard size for pamphlets, etc., was read and adopted.

STANDARD SIZES FOR PAMPHLETS, ETC.

The committee recommended the adoption of the same general dimensions as have been adopted by the Master Car Builders' Association, with the exception of the postal card, which should be made 3½ × 5½ in., to correspond with the government size. This change was made at the Master Car Builders' Convention this year.

An amendment to the constition was proposed, whereby the Secretary is to be appointed by the Executive Committee instead of being elected by the members. Action was deferred until the next meeting under the rules,

WEDNESDAY'S SESSION.

The president called the meeting to order at 9:15.

The report of the committee on "Shop Tests of Locomotives" was read.

SHOP TESTS OF LOCOMOTIVES.

Inasmuch as the American Railway Association decline to furnish funds for the ordinary expenses of the Testing Committee and as the Conference Committee was unable, because of the general depression in business, to raise the necessary money, the committee has undertaken no tests, and presents as its report the outline of tests given in a report made to the Conference Committee last August. The substance of this report was published at the time that it appeared, and we therefore shall not make any abstract of it now.

MR. FORSYTH: It seems perfectly useless to continue a subject of this kind until the Association has devised some way of providing funds for carrying on the work. I suggest, therefore, instead of continuing the committee, the subject be continued and be referred to the executive committee until such time as the Association has devised some means for carrying on the work, and then appoint a new committee. There are other members who would like to be on this committee; they should be given an opportunity. I move that the committee be discharged, subject continued, and when the Association has funds to provide for the work, a new committee appointed. (Carried.)

The report of the committee on "Gages for Sheet Metal Tubes and Wire" was then read.

GAGES FOR SHEET METAL, TUBES AND WIRE.

The committee was instructed to confer with manufacturers and others and submit a practical system for adoption by the Association. The committee arranged a meeting with a similar committee of the American Society of Mechanical Engineers, which was held last November, which joint committee recommended the use of micrometer calipers or notched gages, the gages to be dimensioned in thousandths of an inch and marked in terms thereof. A circular sent out to ascertain the opinion as to the introduction of the decimal system was replied to by about 8 per cent. of the members and the manufacturers to whom it was sent. Of these, members of the Association in favor of the decimal system were 43; opposed, 3. Manufacturers in favor, 25; opposed, 6. While less than one-tenth of the members of the Association do not take enough interest in the work of the Association to answer a circular which would require but 15 minutes, yet the answers received were practically unanimous in favor of the decimal system. Another meeting was held by the joint committee, and the result is that the committee recommends a solid elliptical gage as shown in the engraving, and makes the following further special recommendations:

We now have to recommend to this Association for its adoption as standard:

1st. The micrometer caliper should be used for laboratory and tool-room work and in the shop when specially desired.

2d. The solid notched gage should be used for general shop purposes.

3d. The form of this gage shall be an ellipse whose major axis is 4 in. the minor axis 2.5 in. and the thickness .1 in., with a central hole .75 in. in diameter.

4th. The notches in this gage shall be as follows:

Inches.	Inches.	Inches.	Inches.
.002	.022	.060	.110
.004	.025	.065	.125
.006	.028	.070	.135
.008	.032	.075	.150
.010	.036	.080	.165
.012	.030	.085	.180
.014	.015	.090	.200
.015	.050	.095	.220
.018	.055	.100	.250
.020	....	....	.250

5th. All notches to be marked as in the above list.

6th. The gage must be plainly stamped with the words "Decimal Gage" in capital letters .2 in. high, and below this the words "Master Mechanics."

7th. In ordering material the term gage should *not* be used, but the thickness ordered by writing the decimal as in above list. (For sizes over ¾ in. the ordinary common fractions may be used.)

The Pratt & Whitney Co., of Hartford, Conn., offer to furnish the Solid Elliptical gages, notched as shown in the cut, for $5 each, if the use of the gage warrants their making the necessary tools for their production.

After the suggestion of sundry minor corrections in the report, the gage was adopted as the standard of the Association. The report of the committee on the "Utilization of Railroad Scrap Material" was read.

UTILIZATION OF SCRAP MATERIAL.

The committee has found it impossible to formulate any rule capable of general application for the handling of scrap material; conditions vary widely. The plan suggested provides for a double inspection of the material and for the turning into stock of material that may be used again without preparation. The general principles have been laid down in the able paper of Mr. J. N. Barr, read before the Western Railway Club and published at

the time in the *Railroad Gazette*. The scrap pile should be in charge of intelligent persons and the material should be handled as systematically and as carefully as new material.

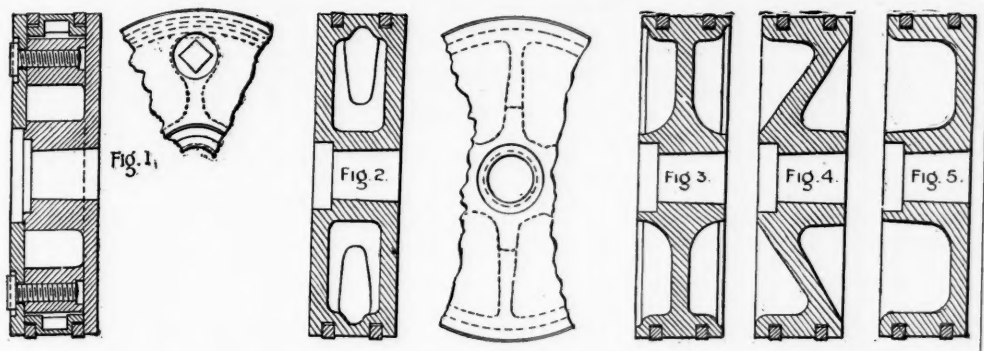
Figures as to the cost of working over old material are lacking. The committee then goes on to enumerate some of the methods in use for working up scrap material. This subject was thoroughly discussed after the publication of Mr. Barr's paper, therefore we shall not now print the information given by the Committee.

Mr. Sprague moved that the report be received and the committee discharged. (Carried.)

The report of the committee on "Pistons, Piston Rods and Fastenings" was read.

PISTONS, PISTON RODS AND FASTENINGS.

The Committee first describes the pistons in current use, being the bull ring piston, Fig. 1; the box piston, Fig. 2; the single plate, Figs. 3, 4 and 5. In bull ring pistons the follower plates are in most cases quite long and screwed into holes in the spider arms. In a few cases they are screwed into brass ends previously inserted in the arms through lateral openings. Some of the designs indicate that the ring is a close fit, while others indicate that a space is left upon the inside of the ring and the ends of the arms to be subsequently filled with liners.



Box pistons are cast with internal cored recesses or made in parts, subsequently fastened.

The single plate pistons have no internal cored recesses, but are solid throughout and made in three forms, as shown, which may be called the central plate, inclined plate and side plate. The London & Southwestern uses a 17½-in. piston of this form, with two snap rings; the Manchester, Sheffield & Lincolnshire uses an 18-in. central plate piston with two snap rings. Other roads also use this form. The Pennsylvania lines (northwest system) have in experimental use a side plate form with two snap rings. The London & Northwestern uses a side plate and three rings. The Pennsylvania Railroad has in experimental use an inclined plate piston with two rings; the Chesapeake & Ohio 20-in. piston is of the inclined plate form with two snap rings. Other instances of practice are mentioned.

The advocates of the bull ring piston claim that it is absolutely the only form which, when repaired, can be made at small expense to completely fill the cylinder. For the box piston the claim is made that it is simple, cheap and has no loose parts and that it can be made in cast iron of sufficient strength for usual diameters. It is claimed for both these types that the cylinder heads may be made in the simplest possible form and the clearances reduced to a minimum. Also that such pistons having internal air spaces embody the most practical non-radiating construction.

The single plate piston best combines strength and lightness.

The question has been raised whether or not it would pay to polish the faces of pistons of whatever type; also the inner faces of cylinder heads, with the idea that such polished surfaces would not hold the water condensation, reducing the condensation when steam is admitted. An experimental settlement of this question would be complicated by the impossibility of giving a smooth finish to the inside of the ports.

No fixed rule seems to be observed in determining the relation of the width of the piston to its diameter, but in general it may be said that the best accepted practice in the matter of 20-inch pistons is to make them from 5½ to 6 in. wide on the face. It does not follow, however, that all pistons should be in the same proportion; for instance, the 30-in. piston used by Mr. Webb on the London & Northwestern Railway is only 5 in. wide across the face.

Some of the desiderata in a locomotive piston are strength, lightness, cheapness of first cost, cheapness of maintenance and renewal, minimum exposed surface, with reference to condensation, fewest parts possible that can work loose and knock out cylinder heads, and a good system of packing rings.

It has been difficult to ascertain the weight of any considerable number of pistons of the several types, and the following represents all the information of this character that has reached the committee:

18-in. pistons: London, Brighton & Coast, single plate (side), cast steel, 130 lbs. Manchester, Sheffield & Lincolnshire, single plate (side), cast iron, 144 lbs. Canadian Pacific, single plate (central), cast iron, 172 lbs.

19-in. pistons: London & Southwestern, single plate (side), cast steel, 142 lbs. Pennsylvania Railroad, single plate (side), cast steel and cast iron, 186 lbs. Great Western Railway, single plate (side), cast iron, 207 lbs.

20-in. pistons: Richmond Locomotive Works bull ring, cast steel, 257 lbs. Norfolk & Western, box, cast-iron, 275 lbs. West Shore, box, cast iron, 292 lbs. Schenectady Locomotive Works, single plate (central), gun iron, 187 lbs.

29-in. pistons: Old Colony (Dean design), box, cast iron, 450 lbs.

30-in. pistons: London & Northwestern, single plate (central), cast steel. 288 lbs. Schenectady Locomotive Works, single plate (central), cast steel, 354 lbs.

31-in. pistons: Southern Railway, E. T Division (Richmond Locomotive Works), single plate (central), cast steel, 387 lbs.

Concerning piston rods: The inquiries of the committee lead to the conclusion that the taper fit for both ends may be considered standard. A square shoulder between the taper fit and cylindrical portion is bad, localizing strains. One way to avoid this is by introducing a large fillet; another is to introduce a blunt taper in place of the square shoulder; another is to carry the original taper beyond the piston or cross-head fit until it merges into the cylindrical surface of the piston rod. Another recourse is to reduce the section of the piston rod for a short distance outside of the cross-head fit; never at the piston fit, tending to relieve the cross-head fit from bending strains and to localize these in a reduced cylindrical section. This practice has been extensively followed on the Michigan Central with almost complete freedom from broken rods. The same idea has been carried out by reducing the entire length of the piston rod between the piston fit and the cross-head fit, involving a split stuffing box, considered by many very objectionable.

The committee then describes briefly the common practice in fastening the piston rod into the piston by nuts, iron, steel or brass, or by riveting the end of the rod into a counter-sunk recess, and inserting the key through the hub of the piston and the fit of the rod. The prevalent practice for securing the piston rod to the cross-head is a taper key. In packing rings the most prevalent practice is cast iron, with a simple lap or beveled or square joint, the simple lap being the most general. A few of the English roads use brass packing rings. The almost universal American practice is cast iron. The London & Northwestern's brass rings are reinforced by heavy (½ in. round) spring, operating against an internal beveled surface on the back of the rings tending to force them out and sidewise. The Lake Shore and the Erie use the Dunbar sectional packing. The combined section of the two rings on the Lake Shore in 17-in. pistons is ¾ in. in width, 1 in. in thickness. For the 20-in. piston, as used by the Erie, the dimensions are ⅞ in. width, ⅞ in. thickness.

A table has been prepared showing sections of rings in common practice:

SECTIONS OF PISTON PACKING RINGS.

Party.	Diam. of piston.	No. of Rings.	Width of section.	Thickness of section.
	In.		In.	In.
Erie (compound)	16	2	1	3/16
Lake Erie	17	2	¾	1
Atchison, Topeka & Santa Fé	17	2	⅞	¾
London & Southwestern				
Manchester, Sheffield & Lincolnshire	17½	2	¾	1/16
Canadian Pacific	18	2	¾	1/16
Baltimore & Ohio	18	2	⅞	3/16
Union Pacific	18	3	1/16	1/16
Grand Trunk	18	2	¾	3/16
Pennsylvania Railroad	19	2	1/16	¾
London & Southwestern	19	3	⅝	1/16
Delaware & Hudson	19	2	1	5/16
Chesapeake & Ohio	20	2	¾	¾
Richmond Locomotive Works	20	2	⅞	1/16
Norfolk & Western	20	2	1-8	5/16
Fitchburg	21	2	¾	¾
Erie (compounds)	27	2	1	⅞
Old Colony (Dean)	29	2	⅞	⅞
London & Northwestern	30	2	1	1/16

Conclusions.

The conclusions of the committee are briefly that for pistons of moderate diameter and for use in slow-speed engines, there is an open choice between the bull-ring form and box form, while for pistons of any diameter, if for high speed engines, the single plate type presents the important advantages of lightness, combined with strength. In piston rod fastenings the taper fit with nut at the piston end and key at the cross head end seems to be the arrangement which is justified by the best practice. The tapers which are in current use vary between the extremes of ⅜ in. in diameter in 12-in. length to 1½ in. diameter to 12-in. length, while a fair mean representing average practice may be considered to be 1 in. in diameter in 12-in. length.

The committee acknowledge that they have availed themselves in this report of considerable information which was collected by a committee of the Southern & Southwestern Railway Club on the subject of counterbalancing of locomotive driving wheels.

On motion the report was received and the committee discharged.

MR. BARNES: I think it is too bad to discharge this committee. What we want to know is the kind of material and how thick it should be, and that only can be determined by experiment, as mathematics has failed to give us the correct thickness.

From Figs. 3, 4 and 5 of report, one would suppose they would have to be cast iron pistons. It is understood you can use cast steel, wrought iron or forged iron pistons against cast iron cylinders. In the making of compound locomotives we are compelled to reduce the weight of the reciprocating parts and use cast steel pistons. We ought to discuss the matter to see what material to use for the light pistons, and how thick to make them. With the large pistons of cast iron it is nearly impossible to balance the engine so that it will not injure the track.

MR. GORDON: I notice in the report it is stated that where the body of the piston is made of steel or wrought iron it is customary to tin the outer edge where it bears against the cylinder walls. I would like to hear what has been the experience in regard to the wearing of the tin.

MR. DAVIS: The Richmond Locomotive works did this in compound engine pistons, 29 and 32 in. in diamater. When the question first came up we adopted the form shown in Fig. 4, as being the strongest form for the least amount of weight. In Fig. 5 while the web is slightly shorter it does not take the strain to such advantage as in Fig. 4. We used the best 80,000 lbs. steel, cutting a dove-tail groove in the middle of the piston face and filling that with tin or babbitt. This worked very successfully and did not cut the cylinder at all. The tin, however, would break up by the change of temperature, and we then cast the ring of bronze in sections, casting about $\frac{1}{12}$ of the section at a time, and turning the ends of each section to its preceding section so that when the ring was cast the shrinkage would not break it apart. After the ring was cast, the piston was put back in the lathe and the bronze ring turned up so as to project $\frac{1}{32}$ of an inch beyond the face of the steel piston. This proved to be very effective and prevents any trouble whatever from the steel pistons.

MR. MANCHESTER: I would like to know what the form of the boss is on either of the cylinder heads.

MR. DAVIS: In the case of the compound engine in the low-pressure cylinder, the heads are made to conform very closely to the shape of the piston. As the piston is turned up to a template, and it is very easy to turn the heads to fit the piston very closely. When we first began building two-cylinder compounds, we did not realize how much clearance we would require in the high-pressure cylinder, and made the piston and cylinder heads flat in the ordinary way. We very soon found out, however, in running the engine at high speeds, it would be necessary to either cut out the exhaust openings of the valve to a very objectionable degree to avoid excessive compression, or else give more clearance in the cylinder. We therefore introduced the "Z" form of piston in the high-pressure cylinder and left the cylinder heads flat. This has given the requisite amount of clearance space at the ends of the cylinders, and gives a very light and strong form of piston head.

MR. GENTRY: I see that the committee in touching upon the piston rod do not make any recommendation as to the material for rods, nor do they give us any experience of members on that point. We have a great deal of trouble with broken piston rods, and as a rule it has been the cross-head ends, though in some few instances half way between the stuffing box and shoulders. We have tried all the best forms of steel, hammered iron, double refined hammered iron, some of the cross-grained hammered iron, imported iron, and broken them all. Our practice has been for engines of a given cylinder to make them as large as has been customary, under the best practice. We give a great deal of attention to the form and size of the key at the cross-head. The form of packing with which the brakes occur is that in general use, namely, the bull ring packing. These brakes occurred with the various types of Laird guide.

MR. HERR: The recommendations seem to lean strongly to the single plate piston. We have had some experience with that type, made similarly to the form first spoken of by Mr. Davis. Our experience has been unfavorable. They run very nicely for a time, but the babbitt rings break up and give serious trouble. I question very much whether the bronze ring will be a permanent improvement. I believe we have not reached the limit of lightness of design for a bull ring type of piston. That type posseses many advantages over the others, there being but a small inexpensive part of the piston to renew.

We have a great deal of trouble in the breaking of piston rods on all classes of engines. A year ago while in Germany I took occasion to investigate this matter as thoroughly as I was able. I could not find that they had any touble with broken piston rods. Instead of making the rod with the tapering end, that fits into the cross-head, the smallest part, they make it the largest. To do this with our practice would entail two split stuffing boxes and split packing rings. They use almost exclusively the hemp packing. They fit the key carefully without sharp corners and use very large fillets between the end of the rod and the body. Our practice of going to large piston rods as breakages occur, is objectionable, not only from the standpoint of increasing dead weight of the reciprocating part, but also from the fact that it takes just that much more area from the back side of the piston.

MR. GENTRY: I lately examined a cylinder in which the cast steel piston had been provided with a brass pack-

ing ring, and had made considerable mileage. The cylinder had become perfectly glazed, and while the brass ring had worn down visibly, the cast steel being almost in contact, yet there did not seem to be any tendency for the steel to scrape up the cast iron. I accounted for this from the fact that if we introduce into a newly bored cylinder, a newly turned steel piston, the two rough surfaces immediately engage each other and this action commences. If we can introduce something in the piston that will prevent the scratching or cutting until we get the cylinder thoroughly glazed, this is less apt to occur. It is possible that the plan of introducing the brass ring is the nearest thing we can get. As to the method of fastening the piston head to the rod, we tried the brass nut, but found it quite difficult to keep tight, and now we use iron. Just why they will not stay tight after being properly fitted I do not know. We warm the cast iron or steel head, as the case may be, and shrink it on.

MR. DAVIS: I will give a little experience with the cast-steel piston in connection with the cast-iron cylinder. On the first compound we built at Richmond for the Chesapeake & Ohio road, we put a steel piston with babbitt in the groove in the low-pressure cylinder, and an ordinary cast-iron box piston with bull ring high-pressure cylinder. This engine has been in service about three years. Recently when the engine was in the shop for some general repairs, it was found necessary to rebore the high pressure cylinder on account of wear from the cast iron piston, but the low pressure cylinder with the steel piston, was in such fine condition that it was impossible to discover any appreciable wear whatever.

MR. GIBBS: The question of broken piston rods is not a question of quality of material only. We have tried all qualities of iron, from the best English to the ordinary American, and we have had a great deal of trouble with them all. There must be something wrong with the general practice in this country in making a taper fit piston rod with an approximately square shoulder.

MR. MCKENZIE: It would be interesting to know what kind of cross-heads they are using. The experience we have had with 26 engines fitted with the common four-bar guide, 3-in. piston rod and 19-in. cylinder, has been that we broke the rods as fast as we could get them.

MR. HICKEY: About seven years ago a committee reported on the relative merits of the cross-heads. Among others they mentioned the Laird cross-head, and from that time they have been generally used. Prior to their adoption, I do not think there was much trouble from broken piston rods, but after their use the broken piston rods commenced. I believe to that cross-head is due most of the broken piston rods. Mr. Herr has made some remarks as to what he found in Germany and the freedom from breakages. I inquire what character of cross-heads they use; for I believe if we enlarge the piston rods the broken rods will be with us still.

MR. HERR: The cross-head used in Germany is principally the two-bar type of guides. I saw none of the Laird type. There is no doubt that the Laird cross-head is largely responsible for a great number of broken piston-rods. We have broken rods not only on engines equipped with the Laird, but with engines equipped with the four bar guides. The breakage of these rods is the most serious where the ends of the rods are turned down and considerably smaller than the body. It usually occurs inside of the fit.

MR. MCCONNELL: The Laird cross-head and steel piston rod is the worst thing you can put on a locomotive. More piston rods are broken from that source than any other. We rarely have a piston rod broken from the four bar guide. I do not believe you can use any kind of piston rod in the Laird cross-head that will not break.

MR. PATTEE: We have something like 225 engines, ranging from 19 × 24 to × 20 26 cylinders, working 180 lbs. pressure, all Laird type; not a single rod has broken. I think it is, perhaps, partially due to turning down the end of the rod very little, thinking it is cheaper to replace a rod than to replace piston, cylinder head and rod. The cross-head is 19½ to 21½ in. long.

MR. WELLS: It seems to me the breakage of piston rods is mostly due to the cross-head being out of balance. I have taken a cross-head of the ordinary size, and have found that its center of gravity was 4¾ in. above the center line of the piston rod, and it weighed probably 325 lbs. We found that breaks occurred mostly on engines with that kind of cross-head, under high speed. They had 4 ft. 6-in. wheels, and ran 50 miles an hour. The effect of the eccentricity of the center of gravity would necessarily cause the rod to break in time. I know the Laird cross-head has been used for a number of years with good success, but it was where the engines were run at moderate speed.

The cross-heads used with four bar guides often cause breaks by the same eccentricity of the center of gravity. With two bar guides, one above and one below, I have not known of any trouble from broken piston rods, because such cross-heads are balanced.

MR. FORSYTH: The next report should be accompanied by detail drawings of large pistons, the details of the piston rings and the fitting of the piston rods to the piston, and also the piston rod to the cross-heads. I do not think the enlargement of the piston fit in the cross-head is necessary, for the reason that in recent years, to my knowledge, we have not broken any piston rods in the smallest section through the key-way. We have been troubled with breakage of piston rods of large diameter, both with the Laird cross-head, and with the wide spread guides, which is a balanced cross-head. I think the reason is largely, if not solely, due to the shoulder on the piston rod. I do not think it is a matter of quality of material, because we have obtained the best quality of iron and steel, and have had them break in about the same time. They should be fitted without the shoulder. In regard to the plate and box shaped piston, I think there is more hope for the plate design, especially in large diameters, because I do not think Mr. Herr would advocate the use of bull rings and double plates in 29, 30 and 32-in. pistons.

MR. HERR: As to the bull-ring piston, I did not contemplate advocating that piston for a low-pressure cylinder in a two-cylinder compound. I do not think it is practicable to use there.

Mr. Manchester moved that the subject of piston rods and allied parts be made one of the subjects for a report next year. (Carried.)

The Committee on Riveted Joints then reported.

RIVETED JOINTS.

The report of the committee on riveted joints contains a long mathematical discussion of various joints, giving their efficiency, dimensions, etc., which we do not reproduce. We take from the report, however, the four tables given herewith, showing the dimensions, the size and position of rivets, and efficiency, of single and double-riveted lap joints, of double-riveted butt joints and double-riveted lap joints with inside welt.

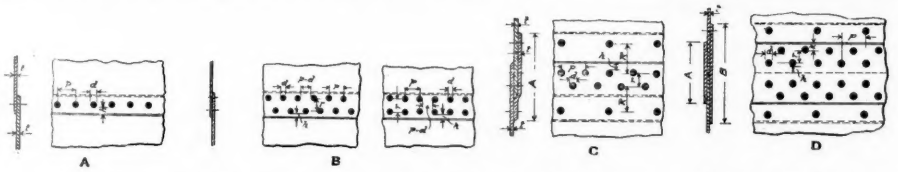
The dimensions of single-riveted lap joints given in the tables have been deduced, using a tensile strength for steel boiler plate of 56,000 lbs., a shearing strength of 38,000 lbs., for rivet iron, and a safety factor of 10; also by making the joints no more likely to fail by shearing than by tearing along the net section of the plate or breaking through the margin. The dimensions of the double-riveted lap joints have been deduced the same way. The butt joints have been calculated by making the joint more likely to fail by tearing of the plate along the outside row of rivets than in any other way. The condition limiting the pitch is that the intensity of bearing pressure shall not exceed 80,000 lbs. per square inch of the projected area of the rivets, this limit not to be passed in any of the joints. The use of smaller rivets than those given in the tables will result in a loss of efficiency. With good workmanship and with drilled, punched and reamed, or punched and annealed plates the committee thinks that the actual efficiencies obtained would, if anything, be greater than the calculated ones. In the double-riveted butt joints the width of the margin for the main plates has been calculated to resist a bearing pressure of 80,000 lbs. per square inch of projected bearing area of rivet. The margin for the welts is the same as that in a single-riveted lap joint between plates of the same thickness as the welt, and with rivets of the same diameter as those used in the butt joint.

C.—LAP JOINT, WITH INSIDE WELT.

t	d	p	h	r	R	A	Efficiency.
in.	in.	in.	in.	in.	in.	in.	p. c.
¾	13/16	2 1/16	¾	1 5/16	3 1/16	10 1/16	84.9
"	7/8	3 1/16	7/8	1 1/16	3 9/16	11 1/16	86.2
"	15/16	3 5/16	15/16	2 1/16	3 15/16	12	87.0
"	1	4 1/16	1 1/16	2 1/16	5 7/16	13 3/16	87.6
7/8	7/8	2 1/16	7/8	1 1/16	3 1/16	10 1/16	84.4
"	15/16	3 1/16	15/16	1 1/16	3 9/16	11 1/16	85.2
"	1	3 5/16	1	2 1/16	3 15/16	12 1/16	85 5
"	1 1/16	4	1 1/16	2 1/4	4	13 1/16	86.7
1/16	1	3 1/16	15/16	1 7/16	3 3/4	12 1/4	84.3
"	1 1/16	3 5/16	1	2 1/16	3 13/16	13	85.0
"	1 1/16	4	1 1/16	2 1/16	4 1/16	13 1/16	85.8
"	1 1/16	4 3/16	1 1/16	2 1/16	4 1/16	14 1/16	87.4
9/16	1 1/16	3 1/4	15/16	1 1/16	3 7/8	12 5/8	83 6
"	1 1/16	3 5/8	1	2 1/16	4 1/16	13 5/8	84.2
"	1 1/16	4	1 1/16	2 1/16	4 1/16	14 1/8	85.0
"	1 1/4	4 3/16	1 1/16	2 1/16	4 5/16	15 5/16	85.7
5/8	1 1/16	3 5/8	1 1/16	2 1/16	4 1/16	14 1/8	83.6
"	1 1/8	4	1 1/16	2 1/16	4 1/16	14 1/8	84.3
"	1 1/16	4 7/16	1 1/4	2 5/8	4 1/2	16 1/16	84.3

D.—BUTT JOINT WITH TWO WELTS.

t	d	p	h	k	e	A	B	Efficiency.
in.	in.	in.	in.	in.	in.	in.	in.	p. c.
5/8	13/16	2 1/16	7/8	¾	1 1/4	8¼	13 1/4	86.1
"	7/8	3 1/16	7/8	1 1/16	1 1/2	9	14 1/2	86.2
"	15/16	3 3/16	1	1 1/16	1 1/8	9 5/8	15 1/4	86.1
"	1	3 5/8	1 1/16	1 1/16	2 1/16	10 3/8	16 7/8	86.2
7/8	7/8	3 1/16	7/8	1 1/16	1 1/16	8 7/8	14 3/8	86.2
"	15/16	3 3/8	1	7/8	1 1/16	9 1/2	15 3/8	86.1
"	1	3 5/8	1 1/16	1	2 1/16	10 1/4	16 1/2	86.2
"	1 1/16	3 7/8	1 1/16	1 1/16	2 1/16	10 7/8	17 1/2	86.2
1/16	1	3 5/8	1 1/16	1 1/16	2 1/16	10 1/2	16 7/8	86 2
"	1 1/16	3 7/8	1 1/8	1	2 1/16	10 3/4	17 1/2	86.2
"	1 1/16	4 1/16	1 1/4	1 1/16	2 1/16	11 1/2	18 1/4	86.1
"	1 1/16	4 1/16	1 5/16	1 1/16	2 1/16	12 1/4	19 5/8	86.2
"	1 1/16	3 7/8	1 1/8	1 1/16	2 1/16	10 5/8	1 3/4	86.2
9/16	1 1/16	4 1/16	1 1/8	1	2 1/16	11 3/8	17 1/8	86.1
"	1 1/16	4 1/16	1 5/16	1 1/16	2 1/16	12 1/8	19 1/4	86 2
"	1 1/4	4 1/16	1 3/8	1 1/16	2 1/16	12 7/8	20 3/8	86.3
5/8	1 1/16	4 1/16	1 1/16	1 1/16	2 1/16	12	18 7/8	86.2
"	1 1/4	4 1/16	1 3/8	1 1/8	2 1/16	12 3/4	20	86.3
"	1 1/16	4 1/4	1 1/16	1 1/4	2 1/4	13 1/4	21 3/8	86.1
11/16	1 1/16	4 1/4	1 1/16	1 1/16	2 1/4	13 3/8	21	86.1
"	1 1/8	5	1 1/2	1 1/4	2 5/8	14	22	86.2
¾	1 1/8	5	1 1/2	1 1/16	2 5/8	13 7/8	21 5/8	86.2



A.—SINGLE RIVETED LAP JOINT.

t	d	p	h	Efficiency.	t	d	p	h	Efficiency.
in.	in.	in.	in.	p. c.	in.	in.	in.	in.	p. c.
¼	5/16	1¼	5/16	55.0	½	7/16	1¾	¾	47.4
"	7/16	1½	9/16	56.5	"	11/16	1 7/8	11/16	50 0
"	7/16	1¾	¾	56.6	"	1	2 1/16	1	51.5
"	¾	2	7/8	61.0	"	1 1/16	2 5/16	1	52 9
5/16	5/16	1 5/16	5/16	51.6	"	1 1/16	2 1/16	1 1/16	54 9
"	11/16	1½	11/16	54.1	"	1 1/16	2¾	1 1/16	55.6
"	¾	1¾	¾	55.8	9/16	1	2	7/8	48 2
"	¾	2	7/8	57.3	"	1 1/16	2 3/16	1	49 7
"	7/8	2¼	1	59.0	"	1 1/16	2 5/16	1	51.4
3/8	¾	1 5/16	1	52 0	"	1 1/16	2 5/16	1 1/8	53.0
"	¾	1¾	¾	53 5	"	1 1/16	2¾	1 1/16	54.5
"	7/8	2	7/8	55.3	"	1 1/16	3	1 1/4	55.3
"	7/8	2¼	1	55.5	5/8	1	1 7/8	1	46.3
"	1	2 7/16	1 1/16	58.9	"	1 1/16	2 1/16	7/8	47.5
7/16	¾	1 7/16	9/16	47.8	"	1 1/16	2¼	1	48 8
"	13/16	1 9/16	¾	50.0	"	1 1/16	2 7/16	1 1/16	50.2
"	7/8	1 13/16	13/16	51.7	"	1¼	2 9/16	1 1/16	51 6
"	15/16	2 1/16	7/8	52.8	"	1 1/16	2 1/16	1¼	53.1
"	1	2¼	1	55.1					
"	1 1/16	2 7/16	1 1/16	56.4					

B.—DOUBLE RIVETED LAP JOINT.

Thickness of plate (t)	Dia. of rivet hole (d)	Pitch (p)	Margin (h)	For staggered riveting (c)	For chain riveting (c)	Efficiency.	Thickness of plate (t)	Dia. of rivet hole (d)	Pitch (p)	Margin (h)	For staggered riveting (c)	For chain riveting (c)	Efficiency.
in.	in.	in.	in.	in.	in.		in.	in.	in.	in.	in.	in.	
9/16	¾	2 9/16	11/16	1 7/16	1 5/16	68.4	1/16	1 1/16	3 7/16	1 1/8	2 5/16	2 1/16	69.3
"	13/16	2 11/16	¾	1 5/8	1¾	69.4	"	1¼	4¼	1 5/16	2 9/16	2¾	7 .5
"	7/8	3 1/16	13/16	2		71.4	5/8	1	3¾	1 1/16	2 1/16	1 7/8	63.1
"	15/16	3 3/16	1	2	2¼	72.6	"	1 1/16	3	7/8	1 7/8	2 1/16	61.5
1	1	3 7/16	1 1/16	2 3/16	2 5/16	74.1	"	1 1/16	3 5/16	1	2	2¼	66.0
"	¾	2 7/16	⅞	1 5/8	1 5/16	63.7	"	1 1/16	3 9/16	1 1/16	2 3/16	2 5/16	67.2
"	13/16	2 5/8	¾	1 11/16	1 5/8	66.6	"	1¼	4	1 1/8	2 5/8	2 5/8	67.8
"	7/8	2¾	13/16	1 5/8	1 11/16	68 1	1/8	1 1/16	2 7/8	⅞	1 13/16	1 13/16	61.9
"	15/16	3 1/8	⅞	1 7/8	2 1/16	69.7	"	1 1/16	3 3/8	1 1/16	2 1/16	2 1/16	63.9
"	1	3 3/16	1	2 1/16	2¼	70.8	"	1 1/16	3 7/16	1	2 1/16	2 1/16	64.7
1 1/16	1 1/16	3 7/8	1 1/16	2¼	2 7/16	72.2	"	1¼	3¾	1 1/16	2¼	2 1/16	65.7
1/16	⅞	2 5/16	¾	1 5/16	1¾	61.8	"	1 1/16	4	1 1/16	2 5/8	2 11/16	67.1
"	13/16	2 11/16	13/16	1 11/16	1 5/8	66.6	"	1 1/16	2 1/16	1 1/16	1 13/16	1 7/8	60.4
"	1	3 1/16	1	1 13/16	2 1/16	68.0	3/16	1 1/16	3	⅞	1 7/8	2 1/16	61.0
"	1 1/16	3 5/16	1	2 1/16	2 5/16	69.6	"	1 1/16	3¼	1	2	2¼	62.7
"	1¼	3 7/8	1 1/16	2¼	2 7/16	70.8	"	1¼	3 9/16	1 1/8	2 1/16	2 5/8	64 2
"	1 1/16	4 1/4	1 3/16	2 7/16	2¾	72.0	"	1 1/16	3 13/16	1 1/8	2 1/16	2 1/16	65.3
1/8	1	2 1/16	⅞	1 1/8	2	65 6							
"	1 1/16	3¼	1 1/16	1 13/16	2 1/16	67.0							
"	1 1/8	3 1/16	1	2 1/16	2 5/8	68.4							

On motion, the report was received and the committee discharged.

MR. GIBBS: This report is a good compilation of modern practice of riveting joints, and the calculations show on what they are based. I am disappointed in not finding definite recommendations for a particular set of joints which they think best adapted for each particular use. I think too much stress is laid upon the efficiency of the joint and too little on the other considerations of getting a tight joint and one adapted to take care of the varying strains in the various parts of the boiler.

MR. BARNES: I am glad to see the committee, in making the recommended dimensions for laps, have omitted the bad ones. Commencing at the beginning of this report, I would like to call attention to the bad laps in a few words, showing why they are bad. First, single riveted butt joint with two welts. It has important defects of having the inside welt the same length as the outside, and where there is an opportunity to take up the calked edge so that it will not be liable to crack there, they have not taken advantage of it. The same is true of the double riveted butt joint with two welts. The quintuple riveted lap joint has practically no advantages. It gives a strong joint, but which could be obtained by two rivets. We are now using pneumatic calking tools, which are very powerful and liable to injure the sheet. There ought to be back of the calking edge another thickness of sheet, and outside of the edge a row of rivets. The dome lap has given good results, but it can hardly be said to be the best dome lap. It requires the flanging of the dome sheet and top sheet, and no annealing furnace can anneal the sheets after they are flanged. I have made some experiments with boiler laps, and have found that long before the laps pull apart so as to reach the ultimate strength, the plates are separated so that you can stick a knife blade between them. I am glad the committee recommends that in calculating for the lap we should not make any allowance for friction between the sheets. Boilers seldom if ever fail because the rivets are not strong enough to hold the lap together. I have found they crack through a line of rivets, or along the calking edge, due to being calked too hard or with the wrong kind of tool. The boiler ought not to be calked on the inside at the edge of the double and outside welt. The factor of safety in a boiler depends more upon the rigidity of the sheets and their circular form than on the strength of the lap. You can injure a boiler by calking too hard with a round nose tool just as well as with sharp nose tool. The former vary from 1/32 to 1/8 in. You must specify radius and strength of blow to be struck.

MR. MITCHELL: The joints as shown in these tables, if followed, would be amply strong, provided there was flexibility enough, and each designer must design that to suit his conditions. Every one illustrated is in actual service.

MR. DAVIS: I am sorry that this particular form of dome connection to the boiler has been chosen to illus-

trate that part of the subject. I want to refer to a more modern connection, that is the form of flange junction recommended, generally known as the Pennsylvania.

MR. HIBBARD: The committee have given us a mathematical formula for the width of margin outside the outer row of rivets. The simple rule, make the width of margin equal to the diameter of the rivet hole, will give sufficient width to prevent breaking through. The riveted joint is not a beam of the same section throughout its length as assumed, which length is the diameter of the rivet hole. It is wider at the ends. The load, instead of becoming concentrated at the center, as assumed, is away from the center and bears at the sides of the hole, as the sheet shows a tendency to break apart. The recommendation that, if the barrel of the boiler is made of $\frac{1}{16}$ steel, the back head or outside door sheet should be the same, is unusual practice. Regarding safety factors, one of our best known locomotive works use 8.65; and one of the best designers on one of our largest trunk roads, about 7.82, which are not far below the 10 given in the report. The formula for the distance between the rows of riveted joints, gives a distance between the rivet holes somewhat larger than that actually used on many efficient boilers. We would be safe in keeping under rather than going over this rule.

WEAR OF TIRES.

MR. HERR presented in manuscript form the report of the committee on the wear of driving wheel tires. It was accepted. We hope to present it to our readers in the near future.

MR. MCCONNELL: In order to determine what effect high speed, increased weight and increased boiler pressure had on the wear of the tire, I have inspected some of our locomotives covering a period of 20 years. I started in with 16-in. cylinder, 69-in. driving wheel, carrying 140 lbs. pressure, time card speed of 22 miles an hour. After they were worn out they were rebuilt as given below. The 16-in. cylinder, with 140 lbs. pressure had about 28,000 lbs. weight on the driving wheel, and the average wear of the tire on this engine was 14,722 miles per $\frac{1}{16}$-in. of wear; with the engine as first rebult, with steam pressure increased to 150 lbs. and speed 25 miles, tire wear decreased to 11,092 miles per $\frac{1}{16}$; with the 18-in. cylinder, carrying about 73,000 lbs. weight on the driving wheel, 160 lbs. of steam, 10,320 miles per $\frac{1}{16}$-in. with same engines, when we increased the speed to 33 miles and 180 lbs. pressure, we got 8,928 miles to $\frac{1}{16}$-in. with the engines on the fast mail, time card speed 41 miles, weighing 107,000 lbs., and 69,000 lbs. weight on the driving wheels, 180 lbs. pressure, the average mileage was 6,717 per $\frac{1}{16}$-in. That shows the effect of high speed, high steam pressure and increased weight on the driving wheel. The tires were Nashua, Union Steel, Midvale, Krupp and others; the diameters of the driving wheels were the same. The report shows that the wear is very much greater as the weight is increased, and it also shows that even on engines having a less weight than some others where the speed is higher the wear is increased. Those having the highest speed, even with lower wheel weight, show a greater tire wear than those with heavier wheels and slower speeds.

MR. BARNES: In the diagrams in the report there is a oint in the revolution of the driver where there is double the weight and a very high speed. If these conditions are to give a maximum wear we ought to find it on the tire wear diagram, which shows at 90 deg. the minimum wear. I do not see that this committee has established any relation whatsoever between the balancing of the locomotive and the wear of the tire. I have examined a great many diagrams and have been surprised to find some engines where the tires wear almost uniformly; same class and service. I have laid it almost exclusively to the engineer who handles the engines. It is interesting to know that Mr. Herr in his very complete and valuable calculations about this matter has found no reason for imperceptible slipping. Tests have recently been made near Pittsburgh on a road which showed over long distance, that the revolutions of the drivers multiplied by the circumference of the drivers amounted to almost exactly the length of the track.

MR. HERR: I wish to explain that Mr. Barnes is entirely correct—the report shows that the wear is not due principally to the increase in pressure due to the over balancing, but particularly to the slipping of the engine, especially when just starting. A careful engineer at the throttle is one of the most important points in reducing irregular wear in tires.

No report was submitted by the committee on the transmission of power. It was discharged.

A paper from Mr. F. W. Dean on boiler tube heating surface was referred to the Executive Committee, to be published in the report, if approved.

A communication from the Michigan Railroad Commissioners asking for an expression of opinion on the subject of the proper flange for an engine truck wheel was read, and on motion referred to the committee on subjects for next year.

The application of Mr. Francis W. Lane, mechanical editor of *The Railway Age*, for admission as an associate member was read; and on motion referred to the proper committee, to be appointed. William Lannen, Chief Engineer of the House of Representatives, was admitted to honorary membership.

The Committee on Resolutions presented the following, which was adopted:

Resolved. That the thanks of this association are due and are hereby tendered to the New York Central & Hudson River, the Rome, Watertown & Ogdensburg, the Central Vermont, the Grand Trunk, the Pullman and Wagner Palace Car companies, the Thousand Island Steamboat Co., for the transportation facilities extended; to the Entertainment Committee; to the past Presidents of the association, and to *The Railway Age & Northwestern Railroader* for the daily reports of proceedings, and others.

The election of officers followed. Mr. R. C. Blackall was elected President; Mr. R. H. Soule, First Vice-President; Mr. P. Leeds, Second Vice-President; Mr. A. Sinclair, Secretary, and Mr. O. Stewart, Treasurer. The meeting then adjourned.

EXHIBITS.

The General Agency Co., of New York City, has on exhibition a section of the Smith triple-expansion exhaust pipe, for which it is now prepared to give a guarantee for large saving in fuel. The full-sized longitudinal section of the exhaust pipe exhibited shows clearly the operation of the device.

The Syracuse Tube Co., of Syracuse, N. Y., has an exhibit in the Thousand Island House, consisting of samples of lap-welded wrought-iron pipe and tubing.

J. R. Drozeski, of Erie, Pa., exhibits his automatic eccentric cross head and wrist-pin oiler. This oiler is shown in two types, one intended for stationary engines, the other for locomotive work. The latter is used extensively on the Lake Shore & Michigan Southern Railroad. The type for use on stationary engines is employed by the Carnegie Steel Co. and the Standard Oil Co.

The Rand Drill Co., of New York, exhibits a small air compressor, with simple steam and compound air cylinders and inter cooler. This compressor is used to supply air for various pneumatic machinery throughout the exhibits, in conjunction with the Westinghouse pump previously used in addition. This company shows a large assortment of photographs of their various drills, compressors, etc.

The Jerome Metallic Packing Company, of Chicago, is exhibiting one of its latest specialties, the McIntosh pneumatic blow-off cock for locomotives. This cock can be opened by the air pressure applied by the engineer in the cab. It is being used quite extensively on several Western roads.

The Richmond Locomotive Works, of Richmond, Va., exhibits in the office of the Thousand Island House a model of its intercepting valve. This valve was described and illustrated in the *Railroad Gazette* for June 15, 1894.

The New England Machine Co., of Boston, Mass., has on exhibition in the Marsden House a full-sized model of its torpedo injector, and sections of lap-welded wrought-iron boiler tubes.

The Champion steam joint grinder, illustrated in the *Railroad Gazette* of June 14, is exhibited in the tent, by means of a full-sized model showing its working while grinding both ball joints and flat joints. The grinder is exhibited by Mr. Frederick Brandes, of Rondout, N. Y.

The Magnolia Anti Friction Metal Co., of New York, exhibits a full line of bearing brasses, samples of journal-bearing metals, etc. The records of this metal, which has run 20 minutes under 2,000 lbs. per square inch without being impaired show its value.

The Wilmington Malleable Iron Co., of Wilmington, Del., exhibits a complete aluminum and wood model of Brown's patent malleable iron draft rigging, and the diamond coupler. The latter is shown by a full-sized draw-bar head, the bar being cut away to show the construction.

The Coale Muffler & Safety-Valve Co., of Baltimore, Md., exhibits a model of their muffler, with section cut out to show the construction of the device. They also exhibit a pop safety valve. This exhibit is in the pavilion.

The Flohr car coupler, of Buffalo, N. Y., is exhibited near the tent by means of two full-sized couplers, mounted on trucks, so that the operation of coupling and uncoupling may be shown.

Among firms represented at the Convention, but not having exhibits, is the Wagner Car Door Co., of Indianapolis, Ind. This firm makes the Wagner car door, which is a flush door, applicable to old as well as to new cars.

F. J. Roberts, of Detroit, Mich., was also represented, his specialty being a dust guard for car journals.

The Combination Draft Lug & Follower Co., of St. Louis, Mo., is represented at the Convention, but has no exhibit. This company makes an improved draft lug and follower casting of any size to fit different draft timbers.

New Track to July 1.

The statistics of new railroad building, which we have compiled for the half year to June 30, 1895, show that 547 miles of new track were built in that period. This compares with 495 miles of new railroad reported built in the same period last year. The figures do not show much change, but when a continued falling off in the total of new railroad built might reasonably have been looked for, it is encouraging to find that the record of the previous year has not only been reached but an advance made. The figures show only the new railroad completed, ready to be opened for traffic, and therefore give no indication of how great an improvement has come in the outlook for railroad construction. At present the prospects are that a much higher total of new railroad will be added to the existing mileage during 1895 than in the last few years.

The new track laid so far in 1895, is divided by states, as follows:

Arizona	64	Minnesota	8
Arkansas	42½	Mississippi	7
California	24	Missouri	15
Florida	7	New York	21
Georgia	66	North Carolina	32
Illinois	8	Ohio	27¼
Indian Territory	15	Oklahoma	15
Indiana	15	Pennsylvania	47½
Iowa	½	Texas	78
Kansas	1	Utah	1¾
Maine	14	West Virginia	12¼
Michigan	9½		
Total United States			545

The East River Bridge, New York.

NEW YORK, June 26, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There seems to be a disposition on the part of some to rush the initiatory steps in the construction of the new East River suspension bridge from Grand street, New York, to Broadway, Brooklyn. "No time should be lost," "Five years should complete it," etc., etc., are expressions heard from those urging the rush.

For nearly five years a charter has been in existence for two bridges, which until now has remained unused in the undisturbed possession of a private corporation, lacking means to build either bridge.

The new law permits the purchase or condemnation of the rights of this company to the Broadway Bridge; and we understand that the company has prepared plans, acquisition of which will, it is claimed, materially expedite the rush process, so that "the bridge may be commenced within 60 days after the purchase of these plans." As part of the "moderate" but unknown purchase price, the approval of the company's plans by the Federal Government and certain legal points as to condemnation are said to be included.

Let us examine the matter without prejudice. The company has located its bridge about 600 ft. east, or above Broadway Brooklyn.

The cities have the right to build a bridge at or near the foot of this street, with the restriction, however, that the property along the river front, belonging to the ferry company, extending nearly 1,000 ft. below and 300 ft. above Broadway, be exempted from condemnation. This restriction was accomplished by an amendment tacked on to the bridge bill just before its passage. However, this does not narrow down the only available site for a bridge to the Bridge Company's site. The Federal Government would certainly approve any reasonable location, and even two bridges, since the water-way would in no case be invaded, and the required height of 150 ft. above high tide at center of span can be easily maintained.

A certain sense of obligation to the Bridge Company, whose friends in the Legislature favored the Cities' bill coupled with the advantage of controlling the entire situation, will suggest and perhaps dictate the purchase of that part of the Bridge Company's charter bearing on the Broadway Bridge, if it can be had at a reasonable figure, and the figure should be reasonable, for the equivalent advantage is meager, and the Bridge Company still retains its rights to the other bridge covered by its charter. As to the surveys and plans said to be completed, these are probably of a very general character and of no great value. Any surveys would have to be checked, or in fact practically made over. The plans were prepared for a private corporation whose chief study would naturally be to minimize the cost even at the expense of greater stability and public convenience.

The point of view changes at once with the change of ownership. The intention of the Bridge Company was to erect, primarily, a railroad bridge, the convenience of roadway travel, street-car transit and pedestrians being made subsidiary. These conditions are now reversed and, while railroad transit must be provided for, it should in the new plans be made subsidiary to the establishment of a great public highway between the two cities owning it. It is natural to expect that new plans properly prepared would differ radically from the old ones. All bias must now be removed, and the rights of all classes of citizens must be respected, not alone those of a few, and certainly not those of a single railroad corporation.

The time necessary for the completion of new plans need not be great, certainly not greater than that required for the arrangement of other accompanying matters.

The work is a stupendous one, and the rush process is not properly in order at the start. The defects, or rather shortcomings, of the present bridge are now well understood; there cannot be a variety of plans, so there only remains to develop new plans, profiting by the experience of the old bridge. No competitive designs are needed; such would only develop, as in the case of the North River Bridge, eccentricities of treatment.

The new Commission requires an able and experienced engineer familiar with the theory and practice of suspension bridge construction, a man of ample resources in design and construction, a vigorous thinker, an energetic worker, a man of courage and determination, and a man of such recognized probity of character that the professional record of the new bridge will be equal to that of the old one. It could not be cleaner. Such an engineer will promptly develop new plans, doubtless more adaptable, more perfect in every way, than the old ones, however thoroughly modified to meet the new requirements.

Those familiar with the great works of the age realize the importance of enlisting the services of master minds. Rather hesitate than rush at the start. Here the path of the work is marked out for good or for evil, as its destinies are placed in the hands of men of tried professional skill, courage, energy and integrity, or left to the doubtful fate of hasty judgement. The engineer is of more importance than the plans, as he makes or unmakes them. The structure will be quickly built or slowly built, creditable or discreditable, honorable or not, just as it follows, as it surely must, the will of the designer and builder.

The most important duty of this Commission is the selection of its engineer, and it is to be hoped that no error will be made in the selection. FESTINA LENTE.

Repairs Under M. C. B. Rules.

The rules of interchagge which go into effect Sept. 1, proximo, will provide under Rule 8, that "car owners will be chargeable with the repairs of their own cars, when such repairs consist of raising a car so that the drawbars will come within the standard limits of 31½ in. to 34½ in. from top of rail to center line of drawbar; or, when they consist of the addition of handholds or grab-irons to the car, all to conform with the requirements of United States law in these respects." The Secretary was instructed to issue this notice at once, and to announce that this modification of the rule will take effect on July 1, 1895, and that rates of charge to car owners shall be as follows, to include all labor and material: raising one end of one car, 50 cents; applying one handhold or grab-iron, 20 cents.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

In Chicago the signal engineers seem to have a great deal of trouble in getting their money's worth out of their distant signals. The signals are put up all right, but the towermen allow the arms to stand in the horizontal position so long that they get insufferably tired—or, to descend from figurative language, which our interloc-utor has got us into the habit of using, to everyday terms—until the bearings rust so as to become fixed in that position. This has been mentioned in these columns before, and now Mr. Gillingham brings it up in a paper read at the Signaling Club. We print the main portion of Mr. Gillingham's paper in another column. We do not agree with him as to the remedy for the difficulty he describes, for the only rational remedy, where trains are to be run at high speed, is to put up distant signals, at a proper distance from the crossing and *see that they are used* to accomplish the purpose they are designed for, which is to prevent delays when the view ahead is not clear. The derailing switch must be far enough in advance of the distant signal to give the engineman time to stop before he is derailed. But with one of Mr. Gillingham's points we heartily agree, and that is the main reason why we print the paper; if a distant signal is never to be pulled off, a slow board is far preferable. Everybody knows precisely what a slow board means, and it costs only about $3; a saving of $197, more or or less, as compared with a distant signal.

The electric motors for the Nantasket Beach Branch of the New York, New Haven & Hartford, which were described in our issue of June 14, have recently been subjected to preliminary trials, and it is expected that the electric operation of this branch will be begun regularly next Sunday. A trial for speed was made on Friday night, the 21st. One of the motor cars which we have described was attached to a train consisting of three standard coaches, and hauled the train back and forth over the line several times. The newspapers have said that a speed of 80 miles an hour was reached. Officers who were on board at the time tell us that at least 60 miles an hour was undoubtedly reached, but that there was no way of saying precisely what the speed was. Sixty miles an hour is of course all that will be wanted for the service, and we believe that this is the first time that so large an amount of current has been taken off at such a high speed; at any rate, the experience on the Nantasket Beach line will clear up some doubt on this point. After the run with the three coaches, a road engine was attached to the rear of the train, and the electric motor pulled coaches and engine back and forth over the line. On Tuesday of this week a test was made with a motor car having four motors. This was for hauling power rather than for speed. A train of 11 loaded freight cars was hauled over the line and the speed reached is said to have been 25 miles an hour. Five more cars were then attached, the total load being probably more than 450 tons. This train was hauled over the road and pushed back again with no difficulty. We do not know that any one has entertained any doubts of the practicability of doing all this with electric motors; the only question is whether or not in any given case it can be done as economically as with a steam locomotive, and we doubt very much if the officers of the New York, New Haven & Hartford expect to save enough in working expenses to pay the interest on the additional first cost. They have here, however, an excellent opportunity to acquire a kind of knowledge which to them has become very important. That is, with the large suburban service of the system and with the important interurban traffic between large towns scattered along its line, it has become very necessary that actual information should be obtained as to the possibilities and costs of electric working. This we believe is the real object in the Nantasket Beach conversion.

The Investigating Committee referred to in our report of New York legislation is to investigate street railroads only. The bill seems to have been rushed through when the members were intent on going home. The preamble states that the profits derived from valuable municipal franchises are now so great that a popular vote ought to be taken on the question of municipal ownership, and, as, according to the newspapers, certain roads in Brooklyn have watered their stock and wasted their money, keeping some of the stockholders in ignorance of their actions, there ought to be an investigation, etc. In another bill there is an item appropriating $6,000 for the expenses of the committee. If the *Railroad Gazette* were a political paper, it might become our duty to express an opinion as to whether this resolution was got up for the purpose of providing some agreeable summer travel for the members of the committee at the state's expense, but under the circumstances we will wait and see what they do. Mr. Nixon, the Chairman of the committee, lives in Westfield, which would seem to be sufficiently remote from Brooklyn to enable him to arrive at an impartial judgment on the doings of the Brooklyn corporations. Incidentally this investigation will show one of the good effects of the constitutional prohibition of passes. If Mr. Nixon and other members from the western part of the state will only go to Brooklyn often enough the Trunk Lines can get a good share of that $6,000. It is to be hoped, however, that this addition to the passenger earnings will not produce such fluctuations in the receipts of the different roads as to imperil the prospects of the "pool" which the reporters talk about.

In the summary of railroad laws passed by the last session of the New York Legislature, which was printed on page 401 of our last issue, the law relating to the qualifications of locomotive enginemen and telegraph operators was by mistake omitted. This law goes into effect Sept. 1 next, and reads as follows:

> Any person unable to read the time-tables of a railroad and ordinary handwriting, who acts as an engineer or runs a locomotive or train on any railroad in this state; or any person who, in his own behalf, or in the behalf of any other person or corporation, knowingly employs a person so unable to read to act as such engineer or to run any such locomotive, is guilty of a misdemeanor; or who employs a person as telegraph operator who is under the age of eighteen years, or who has less than one year's experience in telegraphing, to receive or transmit a telegrapic message or train order for the movement of trains, is guilty of a misdemeanor.

As we remarked at the time this bill was presented (April 12) little increase in safety can be accomplished by it. As far as enginemen are concerned the requirement of the law is already complied with. All railroad managers have known enough to do that for many years. The requirement in regard to operators is a half way measure at best. It is quite likely that more blunders are made by men who enter the service after they are 18 years of age and after they have had a year of so-called experience, than by those of fewer years and less experience. If the telegraph service is to be improved in the direction indicated by this bill, it must be by more thorough and intelligent examination and training of beginners. Mere years mean very little; and the experience to be demanded is not in telegraphing alone, but in the whole procedure of dealing with railroad orders. The practice of the Michigan Central in this matter, as described by Mr. Torrey in the *Railroad Gazette* last week, would furnish a good object lesson for the New York legislators, or anyone else that wishes to make the railroad telegraph system perfect. That road, though it deliberately ignores the duplicate order system in issuing train orders, a safeguard used everywhere except on the Michigan Central, nevertheless makes a good record of immunity from collisions, by keeping the standard of its personnel always high. But the work of the officers of that road in thus building up an efficient telegraph service is not of a kind that can be prescribed, much less enforced, by a legislative enactment. There must be a degree of energy, fidelity and skill in the supervisory officers far beyond anything that can be pounded into a man or a corporation by legislative precept.

The Engineer of the Future.

The annual address of the President of the American Society of Civil Engineers, delivered last week at the Boston convention, appears elsewhere in this issue. We print it nearly in full, notwithstanding the space that it occupies, for we regard it as a remarkably suggestive and inspiring document.

The underlying idea is that the world has entered on a new epoch—one of the great historical epochs of the human race—that when mankind began to manufacture power the race entered one of the most important phases in its development. Truly, this is a grand idea and one of immense suggestiveness. Of this new epoch the civil engineer is, in the estimation of the President of the Society, the high priest, but the greatest results of his work will only be realized by a sacrifice of the individual to the profession. To really carry out his mission he must immolate himself. Within reasonable limits this is true. For the great mass of humanity self-intesest is probably the most powerful impelling force, the force which carries us on step by step in the advancement of the race. But the really great men of the race, the men who have done the constructive deeds in the world's history, have worked with little regard to their own fate. This we imagine would be found true of the greatest names in recorded history; and, coming down to our own time and our own country, it is probable that while Lincoln and Grant and Lee, for instance, began life with a keen desire to advance themselves, in their later years it made very little difference to them what became of them individually. Their own fortunes became to them absolutely insignificant as compared with the enormous interests which they strove to advance.

No doubt the common paths of every-day life are full of men who are capable of self-sacrifice just as absolute; the stuff for heroes and martyrs constantly walks the street by our side. The professions bring the heroic qualities to the surface oftener than other peaceful callings, for they hold up, to arouse the capacity for devotion which is in all men, nobler and more inspiring ideals than are offered in those pursuits the end of which is to transmute human effort directly into cash. All of us know young doctors, ministers and lawyers, some of us know a few old ones, whose controlling ambition is to do a noble work in a noble calling; who really wish to immolate themselves for their professions. These men are precious; they hold up our ideals and our standards of conduct. This spirit of devotion, and the actual practice of devotion, are not unknown in the profession of the civil engineer. We think that we could name several men who are governed by this spirit, unconsciously but actually. Anything that elevates in the minds of men, the conception of the duties and possibilities of the profession of the civil engineer is valuable to that profession and to the whole world; and in this we find the chief value of the President's fine estimate of the relation of the engineer to the new epoch, and of his obligation to his calling.

Bnt while the human capacity for devotion is great and common, there are few men in whom the quality that we may call ideality is so great that they can work persistently and contentedly in the pursuit of an abstraction, however noble; or for a concrete and visible good if it is very remote. However much we may love our profession, however much we may wish to contribute to the happiness and glory of our country, or of the race, we are kept up to our daily work by humbler motives. The force that stands behind us every hour is the desire to get money or distinction, or both, for ourselves and our children. This force the average man can feel, and it holds him fast to useful endeavor; while if he felt only the pressure of a nobler but less concrete ambition he would probably end as a useless loafer.

So, while all that Mr. Morison said about the highest obligation of the engineer to his profession is true, and is elevating, and will help to raise the level of professional conduct, we do not look to see in the profession any very general manifestation of "the true spirit of individual immolation which has characterized the devoted priest of all ages."

To come down for a moment from the general to the particular, we may mention a few points in this admirable address. It will be observed that a new prize is suggested, to be awarded to the paper that calls out the best discussion. It was said that this year the President's address would take that prize if it were established. One part of the address which it was thought would provoke discussion is that which deals

with the relations of American Society of Civil Engineers to othersocieties. Concerning this we shall not stop now to say anything, merely commending it to the attention of the reader.

The paragraph about the library is capital. Here is a simple, concrete suggestion for the good and glory of the Society which any one can appreciate. We hope to see the day, and that soon, when the library will be frequented day and night by engineers, young and old. But we may say in passing that we question if the value and convenience of the library, as it is now, are appreciated by most of the members of the Society. In a year or two, when the new society house is built, and the library is furnished with comfortable chairs and tables, and when all the important recent engineering books may be found on its shelves, it will become a more powerful tool for the advancement of the profession.

Limited Local Tickets.

The complaint about the very short time limit on New York Central local tickets proves to be quite loud. The New York *Herald* and New York *Sun* print several letters backing up the protest of Judge Lacombe, noted in these columns last week, and telling of various inconveniences that their writers have had to put up with. Mr. Coles had some tickets which he could not use and sent them to the general passenger agent on somebody's promise that a check would be forthcoming in a few days. He received the remittance in two weeks, but it covered only a part of the tickets. The rest of them were said to be "of no value," but no reason was given for this statement. He and a friend of his have now decided to purchase in every case a ticket to the first station at which the train stops and then pay the conductor at each intermediate station just enough to carry them to the next station. It will be seen that Mr. Coles and his friend, like many other people, think it is a 'cute trick to bother the conductor because they have something against the general officers of the road.

Mr. Hoxsey, who seems to be a drummer, complains because he has to re-check his baggage when he stops off at several way stations on a division. At his first stop he wishes to prepare for the next stage of the journey as soon as possible, and so he goes at once to the ticket office to buy a ticket; but unless he does this very promptly he finds the office closed until the next train; and if it is not closed, and he stops to get his ticket and get his baggage re-checked, he finds that he has delayed so long that the carriages and omnibuses have all started for town. If he delays buying the ticket until he comes back to the station to resume his journey, 10 minutes are wasted because, according to the rules, he must allow that time for checking baggage. Probably this last point is not of great weight, (unless the drummer has a great weight of extra baggage to be charged for) but it makes a good technicality for use in an argument.

Mr. Alexander refers to the fact that a ticket to be redeemed must be sent by registered letter or express, thus putting the passenger to an annoying and petty expense. He says that a drummer stopping off at several places must take his trunk off with him. We understood at the time this rule was put in force that arrangements had been made to permit a trunk to be checked through while the passenger stopped off. This complaint would indicate that the railroad people had not mustered up sufficient ingenuity to provide a way to check a drummer's trunk through while allowing him to check his smaller baggage from station to station. Mr. Alexander says that a resolution was sent to the legislature last winter, asking the Attorney-General of the state for his opinion as to the rightfulness of the limit rule, but he does not know whether it ever saw daylight after it reached Albany.

General Passenger Agent Daniels has replied to the critics, through interviews with reporters, stating why the company deems it necessary to limit tickets, and asserting that unused tickets are redeemed with reasonable promptness; but this reply falls upon deaf ears, and the passengers' ire is not softened in the least degree. One man says that the limit rule is made to compel the public to assist in forcing the conductors to be honest, and other "kickers" emphasize this point with great energy. They neglect to note, however, that this is only *one* reason. The other principal object is to force passengers to be honest. The main reason for making tickets unusable after two days is to prevent their being used twice, and the possibility of using them twice depends upon either (1) the dishonesty of the conductor or (2) the dishonesty of the passenger combined with the inability or neglect of the conductor to demand the ticket the first time it is used. Of course, every railroad will have to admit that the second cause is the principal one, and also that in offering this reason to the public a good deal of tact is necessary. This inability of conductors to get tickets from all the passengers is a loose feature of American railroad management of long standing and well known, but the cure of the evil is not easily found or applied.

The main ground for asking a passenger to regard the New York Central rule as a reasonable one is that the passenger himself enjoys an advantage from the loose custom, just alluded to, which makes the rule necessary. By letting people get into the cars pell mell and trusting to the acuteness of the conductor to subsequently find them among a crowd of other persons, the road saves the passengers the delay and inconvenience of having to go through a gate. The free and easy American fashion of having railroad stations in the street, or out on the prairie, where any one can step aboard the cars after the train starts, is really a considerable convenience; but people do not seem to think that they ought to be put to any trouble as a compensation for this convenience. Moreover, many of the people who complain probably always take the cars at terminal stations, and thus they do not belong to the class who receive the benefit, or claim not to.

As long as passengers will not admit that they have any duty in the matter the only course for the railroad is to mollify them as best it can. If it does not, the movement to compel a long time limit by law is likely to gather strength until it prevails; and then the only way to get even with dishonest people will be to take up all tickets when passengers enter the cars, a slow and costly process. The feeling that, under the common law, a ticket is good until it is used, is so widespread and so strong that any legislature would be pretty likely to acquiesce in it, sufficiently to pass a law making tickets good, say, six months.

A railroad must put up with some loss and inconvenience as a penalty for being a big corporation. It is true that, if it is to absolutely protect *itself* in every instance, it must require claims to be presented at a central office, to be examined and approved by a half dozen auditors and to be paid only in a rigid routine by the treasurer. But the public will not stand such restrictions unless they get something in return, and *realize* that they are getting it. People put up with red tape regulations at custom houses and post offices because they know that they are paying only cost price, and because they have come to realize in some degree that the red tape has been made by their own tacit approval. They do not realize that one reason why railroad rates are as low as they are is that the company is able to save money by not having an urbane official, at $5,000 salary, at every flag station, to deal with every passenger's grievance with gentle considerateness.

This being so a railroad must either be easy with its regulations and let the scalpers and sharp conductors cheat its treasury; or, if it wishes to rein up the public, give some concession in return. It is a question for each road to decide for itself, of course, whether it will provide the safeguards or save the cost of them and put up with the losses of the present plan.

It is of doubtful expediency for a railroad to have a rule so strict that it must often be suspended or its violation be winked at. Such a rule is sure to be enforced with different degrees of rigidity by different conductors, and the traveling public will never get any settled idea as to what to expect. A liberal rule uniformly enforced is more profitable than a better one constantly causing friction. Placing restrictions upon 99 honest passengers so as to detect one thief is always a delicate matter to handle. Mr. Daniels told a reporter that a ticket returned for redemption had, presumably, been bought; and "the fact that it has been bought is evidence that it may have been used." Such a statement addressed to a claimant, or even suggested, is highly inflammatory. Mr. Daniels may be able to tell people such things without getting them hopping mad; but he is highly fortunate if he has many subordinates who can do it.

May Accidents.

Our record of train accidents in May, given in this number, includes 47 collisions, 58 derailments and 6 other accidents, a total of 111 accidents, in which 25 persons were killed, and 127 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident, as reported, make it of special interest.

These accidents are classified as follows:

COLLISIONS:	Rear.	Butting.	Crossing and other.	Total.
Trains breaking in two	10	0	0	10
Misplaced switch	2	0	1	3
Failure to give or observe signal	0	0	3	3
Mistake in giving or understanding orders	0	1	0	1
Miscellaneous	7	1	3	11
Unexplained	8	5	6	19
Total	27	7	13	47

DERAILMENTS.			
Broken rail	1	Misplaced switch	1
Loose or spread rail	3	Derailing switch	1
Defective bridge	2	Runaway train	1
Defective switch	1	Too quick application of brakes	1
Defective frog	1	Animals on track	2
Soft roadbed	1	Landslide	2
Broken wheel	2	Washout	2
Broken axle	4	Malicious obstruction	4
Broken truck	4	Accidental obstruction	1
Fallen brakebeam	1	Wind	1
Broken car	1	Unexplained	20
Broken siderod	1		58

OTHER ACCIDENTS.	
Boiler explosion	2
Broken side rod	1
Cars burned while running	2
Breakages of rolling stock	1
	6
Total number of accidents	111

A general classification shows:

	Collisions.	Derailments.	Other accid's.	Tot'l.	p.c.
Defects of road	0	9	0	9	8
Defects of equipment	10	13	4	27	24
Negligence in operating	18	4	2	24	22
Unforeseen obstructions	0	12	0	12	11
Unexplained	19	20	0	39	35
Total	47	58	6	111	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other accid's.	Total.
Passenger	13	19	2	34
Freight and other	58	40	4	102
Total	71	59	6	136

The casualties may be divided as follows:

Killed.	Collisions.	Derailments.	Other accid's.	Total.
Employees	6	8	2	16
Passengers	0	3	0	3
Others	0	6	0	6
Total	6	17	2	25
Injured.				
Employees	26	31	5	62
Passengers	33	29	0	62
Others	0	3	0	3
Total	59	63	5	127

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.
Defects of road	1	26	2	6
Defects of equipment	2	3	2	8
Negligence in operating	0	33	8	32
Unforeseen obstructions and maliciousness	0	0	0	9
Unexplained	0	0	4	7
Total	3	62	16	62

Seventeen accidents caused the death of one or more persons each, and 32 caused injury but not death, leaving 62 (56 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with May of the previous five years shows:

	1895.	1894.	1893.	1892.	1891.	1890.
Collisions	47	42	68	61	67	68
Derailments	58	54	102	72	86	56
Other accidents	6	4	6	8	19	5
Total accidents	111	100	176	141	166	129
Employees killed	16	30	39	36	54	43
Others killed	9	4	27	30	9	22
Employees injured	62	70	94	109	98	102
Others injured	65	41	81	114	58	38
Passenger trains involved	34	41	49	47	64	42
Average per day:						
Accidents	3 58	3.23	5.68	4.55	5.35	4.16
Killed	0.81	1.10	2.13	2.16	2.03	2.10
Injured	4.10	3.58	5.65	7.06	5.03	4.52
Average per accident:						
Killed	0.225	0.340	0.375	0.475	0.379	0.504
Injured	1.144	1.110	9.994	1.553	0.939	1.085

Of the three passengers killed in May only one was riding in a passenger train. The accident record is again a comparatively mild one, though there were a number of bad individual cases. The derailment near Elizabeth, N. J., on the 11th, seems to have been due to the carelessness of a signalman, and the case will be of interest to those who hold that a derailing switch causes more loss of life and property than it prevents. Here was a very costly wreck, pinning down the engineman so that he was held in great agony for four hours, and yet there seems to have been not even the shadow of a cause for opening the derailing switch. Nothing is said in the reports about any train on the crossing road, and the signalman evidently awoke suddenly from sleep and opened the switch without first looking to see what train was approaching. This is a kind of negligence that does not very often produce disaster, but which seems to be incurable.

In the wreck of a freight train by a landslide, near Mt. Union, Pa., also on the 11th, there was the possibility of a catastrophe, although it does not figure as a very prominent item in the train accident record An account of this avalanche was given in the *Railroad Gazette* of May 17. The overturning of a freight train by the wind at Eau Claire, Wis., on the 1st, is an unusual item. While no one would think of asserting that such a feat was beyond the power of the experienced western cyclone, it is a fact that standard-gage cars are very rarely blown off the track. As narrow-gage roads are not now growing, either in length or in the amount of business they do, and as standard-gage rolling stock is constantly being made heavier, accidents like this ought to become still more rare.

Runaway engines, which either get caught or are stopped by an ascending grade or by lack of steam before they do any great damage, are heard of every few weeks. But a violent collision, which one expects every time he reads of a runaway, actually occurred near

Clarksville, Ark., on the 4th. Engines run away so very infrequently on any one road that such happenings do not impress themselves upon the minds of enginemen, and so the habit of leaving engines unattended, with the reverse lever in some position other than the middle, continues to be common.

Near Hagerstown, Md., on the 21st, three freight cars escaped control and ran down hill for 16 miles at 75 miles an hour, but the telegraph operators succeeded in getting all trains out of the way and no harm was done. Near Gallatin, Tenn., on the 17th, a hand car being propelled through a very dark tunnel was run violently into the rear end of a freight train standing in the tunnel and the nine men upon it were badly injured. At Lynbrook, L. I., on the 17th, a man was drowned by the running of a hand car into an open draw. The accident occurred in the night and the men upon the hand car thought they were moving it away from the draw when in fact they were running towards it.

Electric railroad accidents occurred in May in considerable variety. On the 18th, at Norristown, Pa., a car fell through a bridge and lodged 20 ft. below on the tracks of the Pennsylvania Railroad. Three passengers and three employees were seriously injured. It appears that when the electric railroad was opened the company placed additional supports under the bridge, but these supports were, it is alleged, at once taken out by the Pennsylvania Railroad people and the bridge was used without them. The Pennsylvania objected to the establishment of the electric line and had entered suit for an injunction against it, the insufficient strength of the bridge being one of the points in the suit.

In Chicago, on the 26th, an electric train, that is, a motor car and one trailer, ran into a wagon on Seventy-ninth street, killing a woman and fatally injuring two other persons. The particulars of this case read like those of a regular old fashioned "railroad accident:"

"The electric train was bowling along Seventy-ninth street at the rate of 25 miles an hour, when the wagon containing a picnic party of 12 persons was sighted. The driver of the wagon whipped up his horses and tried to cross the track ahead of the train, but was not quick enough, for just as the front wheels of the vehicle were clear of the first rail the motor crashed into it and threw the occupants in all directions. The wagon was smashed into kindling wood and the horses were instantly killed. . . . The uninjured persons declared that no attempt was made to stop the electric train and that no gong was sounded, and the first they knew of the train was when it came upon them. . . . It was very dark, but the motorman insists that he saw the wagon and did everything in his power to attract the attention of the driver and induce him to stop his team."

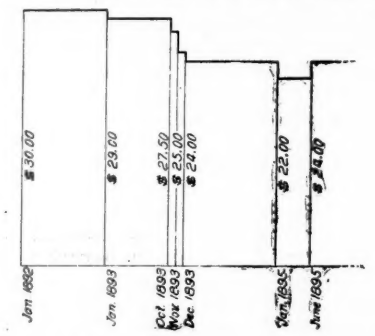
In St. Paul, on the 17th, there was a rear collision of street cars, injuring 10 persons; "the brakes failed to work." There was a similar collision at Bensonhurst, N. Y., on the 19th, injuring seven people badly and 30 or 40 less seriously. At Unionville, near Brooklyn, N. Y., on the Brooklyn & West End Railroad, there was a collision of electric trains which injured only four persons, but the circumstances of which showed the possibilities connected with the present method of operating street railroads. In this case the foremost train had three trailers, all loaded with passengers, and the car which ran into this train had two trailers. Street railroad trains are made up after the style of 1830, but the speed is rated for 1895, or as near to it as possible. On the next day there was another collision in Brooklyn, badly injuring one man. There was a collision on the Shamokin & Mt. Carmel (Pa.) electric line May 10, fatally injuring the motorman. In Philadelphia, on the 20th, a locomotive of the Philadelphia & Reading knocked a trolley car off the track.

A magazine article by Mr. Albert Fink is so rare, and his friends and admirers are so many, that a good many copies of the last *Engineering Magazine* are likely to be sold on the announcement that he has contributed an article to that number; and very likely few of those who buy the magazine will be any the worse off when they discover that the article is a reprint of something that Mr. Fink wrote or said before the Interstate Commerce law was passed. This happens to be the case; and yet it is true that what Mr. Fink says about the relations of railroads to the state is quite as well worth attention when it is ten years old as most writers' statements are when they are new. To illustrate this we quote a sample from the article in question. Mr. Fink said:

Owing to the commercial nature of the transportation business, the laws of trade and commerce, which should govern the management of that business, come, under certain circumstances, in direct conflict with the duties of the common carriers as public servants. The spirit embodied in the common law can be put into practical execution only by restricting or regulating to a certain degree, the operation of the commercial laws—the law of competition, as applied to the business of the common carriers themselves. It cannot be expected that a number of public servants, when engaged in competitive struggles with each other—in other words, when engaged in a free fight—could perform their public duty as common carriers, and guarantee equal and just rates to all shippers. Such guarantee can be given only when these public servants are made to act in concert in all matters relating to their public duty—the establishment and maintenance of reasonable and just transportation tariffs. But, if the public prefers that the laws of competition should remain in full force as between these public servants, it must dispense with the enforcement of the law regulating common carriers, and be satisfied to endure the evils which result from the violation of this law—viz., unjust discrimination, and constant fluctuations in the transportation charges.

This is as true now as it was in 1885, wherever, as at Chicago, the strife between competitors is sharp. Theoretically, the closing sentence ought now to be untrue, for we have a law forbidding unjust discrimination and forbidding fluctuations (except on three days' notice); but Mr. Fink's simple and forcible statement reminds one that this law is a dead letter. We have tried to work an impossible combination. We try to find the golden mean between competition destructive to the railroads, and stability that is so stiff as to kill the shippers, but we have thus far tried it by means that are about as effectual as a clothes brush would be for clearing the Canadian Pacific Railroad of snow in January.

The assurance, in practically all branches of trade, of approaching prosperity, has affected the price of rails more slowly than that of other materials of construction, probably due to the fact that rail renewals by railroads during the past six months have been made very slowly as compared with the activity which has characterized city building and other construction work. Whether due to an increased buying for renewals or to a sympathetic connection between the price of rails and



other materials of construction, the price has advanced from $22 to $24 The accompanying diagram shows the prices for standard sections at Pennsylvania mills since 1891. The rapid fall from $29 to $24 per ton during the three months in the fall of 1893, which accompanied the rapid decline in wages and all prices subsequent to the industrial depression of the latter part of the summer of that year, is well shown in this diagram. The state of unvarying low prices during the past few months has been followed by the recent action of the Steel Rail Association, which at a meeting held in New York on June 20, decided to advance the price of standard sections $2 per ton as indicated on the diagram.

The Railroad Telegraph Superintendents held a very interesting meeting this year, but the report of it consists so largely of addresses of considerable length that we are obliged to scatter it through three issues, there being a great amount of other matter pressing upon our space at this time. To the superintendents who did not attend the meeting we owe an apology for this, but they will find the papers well worth reading. The papers by superintendents show that the members of this association are abreast of the times, appreciating not only the technical but the ethical duties of their office, and those by outsiders show that the superintendents know where to go for sound advice and information when they want it. The papers of Messrs. Thayer, Gemmel, Kinsman and Torrey were reported in our last issue. Those of Messrs. Stewart, Annett, Lockwood, Taylor and Duncan will be treated in this week's and next week's issues. A new trouble with automatic block signals, the unsuitableness of iron telegraph poles in nearly every situation likely to be found in this country, and the increasing value and availability of storage batteries for the telegraph department, and other railroad purposes, are among the chief features of interest, of a technical nature, in the Montreal reports.

Train Accidents in the United States in May.

COLLISIONS.

REAR.

7th, on Pennsylvania road, at Watts, Pa., a freight train drawn by two engines ran into the rear of a local freight standing at the station, wrecking two engines, a caboose and 12 cars. One conductor was injured.

11th, on Georgia Railroad, at Union Point, Ga., passenger train No. 27 ran over a misplaced switch and into some coal cars standing on the siding, which were pushed forward several hundred feet, blocking the Athens Branch. The engine and mail car were overturned. Six passengers and 4 trainmen were injured.

12th, on Seaboard Air Line, near Middleburg, N. C., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking 10 cars. The fireman was killed.

12th, on Lehigh Valley road, at Drifton, Pa., a locomotive standing on a side track unattended started down grade and ran upon the main track to the passenger station where it struck a standing passenger train. The rear truck of the rear passenger car was thrown down a bank and the train was pushed forward several hundred feet. There were only 3 passengers in the rear car and they were not badly injured.

14th, on Pennsylvania Railroad, near Huntingdon, Pa., a car in a freight train was derailed and the train was stopped, though without much damage. A short time later a following freight ran into rear of the standing train and six refrigerator cars were damaged. The engineman was injured.

14th, on Burlington, Cedar Rapids & Northern, near West Bend, Ia., a freight train broke in two and the rear portion afterward ran into the forward one; a brakeman was killed.

16th, on Lake Shore & Michigan Southern, near Amherst, O., a freight train broke in two and, the forward portion being stopped very quickly by the automatic application of the air-brakes, the rear portion of it ran into it with great violence, wrecking 13 cars.

18th, on Central of New Jersey, near Bound Brook, N. J., a freight train broke in two just after starting from a tank and the second portion afterward ran into the forward one, making a bad wreck. Another freight train running at high speed on an adjoining track ran into the wreck and the engine and 12 cars were overturned. The engineer was killed and 4 other employees were injured.

20th, on Southern Pacific, near San Bruno, Cal., a passenger train which was at a standstill was run into at the rear by a following passenger train, injuring 3 passengers.

21st, on New York, Lake Erie & Western, at Pavonia, O., a freight train broke in two and the rear portion afterward ran into the forward one, making a bad wreck. A brakeman was killed.

2d, 4 a. m., on Atchison, Topeka & Santa Fe, near Kenney, Tex., a passenger train, which had been stopped by a breakage in the locomotive, was run into at the rear by a following freight train, damaging the passenger cars and wrecking several freight cars. Several passengers were injured.

22d, 3 a. m., on Union Pacific, near Cheyenne, Wyo., a freight train ran into the rear of a preceding passenger train, doing slight damage, but killing the engineer and fireman. There was considerable fog at the time and the trains were running up hill. It is said that the passenger train was moving about 20 miles an hour and that the freight engineman was new to that part of the road.

24th, on Rockaway Valley Railroad, near White House, N. J., a passenger train ran over a misplaced switch and into some coal cars standing on the side track, making a bad wreck. The engineman was injured.

25th, on Chicago & Northwestern, near State Center, Ia., a local freight train was run into at the rear by a following freight train, and 11 cars were wrecked. Two trainmen were injured.

31st, on Pennsylvania road, at Rohrerstown, Pa., a freight train standing at the station was run into at the rear by a following freight, wrecking one engine and 5 cars. The caboose of the foremost train was burned up by a fire which started in the cooking stove. The engineman was injured.

And 12 others on 11 roads, involving 19 freight trains.

BUTTING.

4th, 4 p.m., on West Shore road, at Syracuse, N. Y., collision between a freight train and a switching engine, badly damaging both engines and derailing 20 cars. One engineman was injured.

4th, on St. Louis, Iron Mountain & Southern, near Clarksville, Ark., butting collision between a passenger train and a locomotive which had run away from a station uncontrolled. Both engines were wrecked and several cars badly damaged. Thirteen passengers were injured. It is said that the runaway engine, which belonged to a freight train, had been detached and was standing at a telegraph office; the engineman was in the office, and the fireman had got off for a moment to get a drink of water.

11th, on Toledo, St. Louis & Kansas City, at Kingman, Ill., butting collision of freight trains, wrecking 11 cars. Both enginemen and 3 trainmen were injured.

29th, on Pittsburgh & Lake Erie, at Beaver, Pa., butting collision of freight trains, wrecking several cars. Two trainmen were injured.

And 3 others on 3 roads, involving 1 passenger train and 5 freight and other trains.

CROSSING AND MISCELLANEOUS.

4th, on Cleveland, Cincinnati, Chicago & St. Louis, at Cincinnati, O., collision between a passenger train and a C. & O. freight train. The fireman of the latter was injured.

27th, on Delaware & Hudson, at Mechanicville, N. Y., a passenger train ran into a switching engine, derailing both engines and throwing one of them against a freight car standing on a side track. One fireman was injured.

30th, on New York, New Haven & Hartford, near Providence, R. I., a freight train running backward collided with some empty dump cars which had been run upon the main track from a siding by mischievous boys, wrecking 4 cars. Two brakemen were injured.

31st, on Chicago & Northwestern, near Escanaba, Mich., collision between a circus train and a freight train, wrecking several cars. Five circus men were injured.

And 9 others on 7 roads, involving 3 passenger and 12 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

9th, on Cleveland, Cincinnati, Chicago & St. Louis, near Farmland, Ind., a freight train was derailed by a loose rail and 18 cars were wrecked. A tramp was killed.

10th, 11 p. m., on Wheeling & Lake Erie, near Massillon, O., a wrecking train which was going to repair trestles that had been damaged by floods was itself wrecked at the trestle over Baker's Creek, which was insecure and the engine fell into the water. The Superintendent was injured, the Trainmaster was drowned and 4 others were injured. A hand car was run over the bridge just before the train went upon it, but the weakness of the structure was not detected.

12th, on Rockaway Valley Railroad, near Pottersville, N. J., a passenger train, consisting of an engine and 2 cars, was derailed at a point where the track had been weakened by a heavy rain, and fell down a high bank. There were only 6 passengers on the train and all were injured, though not seriously. The engineman was nearly drowned.

14th, on St. Louis & Hannibal, near Silex, Mo., a passenger train was derailed by a broken rail and the cars fell down a bank. One passenger was killed, the engineer was fatally injured and 20 other passengers were injured, though only one very seriously.

29th, on Southern Pacific, near Reno, Nev., a passenger train was derailed at a defective switch and the engine and first 3 cars were ditched. A tramp was killed.

And 4 others on 3 roads, involving 4 freight trains.

DEFECTS OF EQUIPMENT.

1st, on Baltimore & Ohio, Woodstock, Md., a freight train was derailed by a broken truck and two trainmen were injured.

12th, on New York, Lake Erie & Western, near Hornellsville, N. Y., a freight train running at high speed was derailed by a broken wheel and 15 cars were completely wrecked. Two men in charge of live stock were killed, and another drover and one brakeman were injured.

14th, on Cumberland Valley road, at Whitehall, Pa., the engine of a passenger train was derailed by the breaking of an axle and several cars were badly damaged. One passenger was injured by jumping off.

15th, 11 p. m., on Boston & Maine, at Bradford, Mass., a passenger train was derailed on a sharp curve by a breakage in the running gear. One passenger was injured.

16th, on New York Central & Hudson River, at Mott Haven, N. Y., the engine of a passenger train of the New York, New Haven & Hartford was derailed by the breakage of the truck center casting.

23d, on Cincinnati, New Orleans & Texas Pacific, near Danville, Ky., a freight train was derailed by a broken axle and 13 cars were wrecked. Two tramps were killed.

26th, on Houston & Texas Central, near Corsicana, Tex., the engine of a freight train was derailed by the breaking of a side rod, the broken rod striking a cap on a small bridge in such a way as to weaken the bridge.

Thirteen cars of cattle were wrecked and a tramp was injured.

And 6 others on 6 roads, involving 1 passenger train and 5 freight and other trains.

NEGLIGENCE IN OPERATING.

7th, on Lake Erie & Western, near Celina, O., a freight train was derailed and 12 cars were wrecked. Two tramps were killed and two injured. It is said that the derailment was caused by the sudden application of the air-brakes.

7th, on Southern Pacific, at Redlands, Cal., two carloads of ice which had become uncontrollable on a descending grade in consequence of the breakage of a brake chain, ran off the track at a curve and were wrecked. A brakeman was badly injured.

11th, 11 p. m., on Lehigh Valley, near Elizabethport, N. J., a freight train was derailed at a derailing switch, and several cars were piled up in a bad wreck, which took fire and was partly burned up. A brakeman was killed, the enginman was fatally injured and 3 other employees were hurt. The trainmen say that the derailing switch, which is at the crossing of the tracks of the Central of New Jersey, was opened after the engine had approached very near to it. The signalman was adjudged by a coroner's jury guilty of manslaughter.

12th, on Seaboard Air Line, at Clinton, S. C., a passenger train was derailed by a misplaced switch, and the engineman and baggageman were injured.

UNFORESEEN OBSTRUCTIONS.

1st, on Chicago, St. Paul, Minneapolis & Omaha, near Eau Claire, Wis., a local freight train was struck by a furious gale of wind and 11 cars and the tender were overturned.

1st, on Chicago Great Western, near Green Mountain, Ia., a passenger train was derailed by a tie on the track and the engine and 3 cars fell down a bank. The engineman and one brakeman were injured.

11th, on Pennsylvania road, near Mt. Union, Pa., a freight train was overwhelmed by a great landslide which covered the track for several hundred feet, and 17 cars of coal were swept into the Juniata River.

18th, on Charleston & Savannah, near Jacksonboro, S.C., a passenger train was derailed at a place where rails had been maliciously removed, and the engine and first 3 cars fell down a bank. Five trainmen were injured.

22d, 2 a. m., on Missouri, Kansas & Texas, near Upton, Tex., a passenger train was derailed at a washout and the engine was overturned. The engineman and fireman were injured.

26th, on Denver & Rio Grande, near Sapinero, Col., a freight train was derailed by a landslide, the engine and 2 cars being submerged in a river.

And 6 others on 6 roads, involving 3 passenger and 3 freight and other trains.

UNEXPLAINED.

9th, on Buffalo, Rochester & Pittsburgh, near Scottsville, N. Y., a freight train was derailed and several cars were wrecked. The engineer was injured.

11th, on Pittsburgh & Lake Erie, at Beaver Falls, Pa., a car in freight train was derailed, and a brakeman was thrown into the Beaver River and drowned.

16th, on Delaware & Hudson, at Saratoga, N. Y., the engine of a passenger train was derailed and ran against a freight train standing on the side track, doing considerable damage. The fireman was killed.

30th, 2 a. m., on Pennsylvania road, at West Philadelphia, a yard engine was derailed and fell down a bank. The engineer was injured.

30th, on New York Central & Hudson River, near High Bridge, New York City, the engine of a passenger train was derailed at a facing point switch, and ran against a freight train standing on a side track. The engineer and fireman were slightly injured.

30th, on Montrose Railroad, near Springville, Pa., a passenger train was derailed and one car containing 10 passengers fell down a bank. It is said that the passengers were not badly injured.

30th, on Galveston, La Porte & Houston, at Deer Park, Tex., a work train was derailed, killing 2 and injuring 3 employees.

And 13 others on 12 roads, involving 2 passenger and 12 freight and other trains.

OTHER ACCIDENTS.

9th, 4 a. m., on New York, New Haven & Hartford, at Hyde Park, Mass., the locomotive of a freight train was damaged by the rupture of a tube and the consequent escape of steam, and a brakeman riding in the cab, who jumped off, was killed. The engineer and fireman were injured, the latter fatally.

13th, on Pittsburgh, Cincinnati, Chicago & St. Louis, near Winamac, Ind., the engine of a freight train was wrecked by the explosion of its boiler and 2 employees were injured.

28th, on Texas & Pacific, at Jonesville, Tex., the engine of a freight train was damaged by the breaking of both parallel rods. The engineer and fireman were injured.

And 3 others on 3 roads, involving two passenger trains and 1 freight.

A summary will be found in another column.

TECHNICAL.

Manufacturing and Business.

Messrs. Robt. Ingham, Clark & Co., of West Ham Abbey and St. Helen's place, London, have converted their business into a private limited company, with a capital of £300,000. No shares are offered to the public.

The Niagara Falls Hydraulic Power & Mfg. Co. has recently installed a rope drive which requires 2,550 ft. of Hunt "Stevedore" rope, made exclusively by the C. W. Hunt Company, New York City.

The directors of the National Tube Works have declared the regular quarterly dividend of 1¾ per cent., payable July 1 to preferred stock of record June 20. The business of the company is showing considerable improvement, there being work ahead to keep mills running practically all summer. Wages have advanced recently 10 per cent., but prices of manufactured material have been sufficiently advanced to allow of a margin of profit above the 10 per cent. wage advance.

The Pennsylvania Bolt & Nut Works give notice that the wages of employees in the puddling and rolling mills at Lebanon, Pa., will be increased 10 per cent., to go into effect July 1 next. The company employs about 1,000 men.

The Brown Hoisting & Conveying Machine Co. and the Elwell-Parker Electric Co., of America, main offices and works at Cleveland, O., have opened a general western office at No. 1528 Marquette Building, Chicago. Mr. F. G. Tallman, Manager of the Pittsburgh offices of these companies, and late Manager at Pittsburgh for the crane department of the Yale & Towne Mfg. Co., will also have charge of the Chicago office, and will be assisted by Mr. Frank B. Ward, late Resident Engineer of the Pittsburgh Testing Laboratory, Limited, and for several years head of the firm of Frank Ward & Co., Inspecting and Consulting Engineers. The Brown Hoisting and Conveying Machine Co., in connection with its hoisting and conveying machinery and crane business has recently purchased the entire crane business heretofore owned and controlled by the Yale & Towne Mfg. Co., as noted in these columns.

The Elwell-Parker Electric Co., of America, which is the American branch of the well-known English firm of the same name, is making a specialty of heavy electric machinery and large installations.

The A. H. Zenner Co., of Detroit, Mich., manufacturers of Zenoleum, a disinfector for passenger cars, have during the past week received orders from the New York, New Haven & Hartford; Chicago, Peoria & St. Louis; Michigan Central; Lake Shore & Michigan Southern, and the Fort Worth & Denver City railroads.

The Standard Guard Rail Fastener Co., of Lancaster, capital $10,000, filed a charter at Harrisburg, Pa., last week.

The C. J. Field Company, of New York City, has been incorporated to conduct an electrical and mechanical consulting and engineering business: Cornelius J. Field, of Brooklyn; Frank Bourne, of Mt. Vernon; and John W. Gilmore, of New York City, are the directors.

The capital stock of the Siemens & Halske Electric Co. has been increased from $1,000,000 to $2,000,000. Of this amount $700,000 is preferred and the balance common stock. The new issue was largely taken by C. T. Yerkes, largely interested in street railroad properties in Chicago, and associates. The new issue was oversubscribed by $500.000. The Grant locomotive plant, at Cicero, which is to be occupied by the works, was purchased with $500,000 common stock, and $200,000 preferred.

The Troy Belting & Supply Co. has been organized to manufacture leather belting and other factory supplies in Troy. Louis Crandall and Arthur G. Gray, of Troy, and G. H. Morrison, of Lansingburgh, N. Y., are the directors.

Charters have been issued to the following Illinois corporations: Lafayette Equipment Co., Chicago; capital stock, $20,000; incorporators, H. H. C. Miller, W. S. Oppenheimer and W. D. Launder. Wayne Furnace Co., Chicago; capital stock, $250,000; incorporators, Charles A. Boos, William R. Adell and William W. Case. Winchester Construction Co., Chicago; capital stock, $500,000; incorporators, George W. Waterman, William R. Odell and William Case. Continental Construction Co., East St. Louis; capital stock, $40,000; incorporators, Edward C. Rice, Royal J. Whitney and Clark L. Whitney.

A charter was issued at Harrisburg, June 24, to the Union Boiler Tube Cleaner Co., of Pittsburg; capital, $5,000, and directors: W. E. Frick, T. C. Lindsay, W. B. Carson, C. E. Henderson, J. M. Lindsay.

Iron and Steel.

The Lackawanna Iron & Steel Co. announces an advance of 10 per cent. in all wages July 1. This affects nearly 6,000 men. The company has orders for its South Works which will keep them running day and night for the rest of this year.

The Carbon Iron & Steel Company's plant at Parryville, Pa, has resumed operations, after a shut-down of over a year. Improvements amounting to $100,000 have been made at the plant.

Creditors of the Pennsylvania and Maryland Steel Companies have received from the Reorganization Committee their certificates of indebtedness of the companies, together with checks for the interest upon the full amount of the indebtedness up to June 21, 1895. The Reorganization Committee also inclosed checks for 30 per cent. of the face of each creditor's claim as part of the cash payment of 40 per cent., provided for in the plan of reorganization. The remaining 10 per cent. will be paid shortly. It is also stated that the new bonds for 60 per cent. of the claims will bear interest from Sept. 1, 1895, the first coupon being payable March 1, 1896. The Reorganization Committee has been in control since June 17. The works at Steelton, Pa., are very busy, employing nearly 4,200 men.

New Stations and Shops.

President Spencer, of the Southern Railway Company, states that plans have been prepared for the new union station at Atlanta, and will soon be submitted to the city authorities and the railroad companies centering there. Considerable property has lately been acquired with this end in view, enough probably for the purpose with what the Southern and Central of Georgia railroads already have.

Work on the new machine shops of the Houston & Texas Central, at Houston, is progressing and the new building will be ready for occupancy this month.

The contract has been let to L. P. Hazen & Co., of Cincinnati, O., to build the Big Four Railroad shops at Wabash, Ind. The contract amounts to $110,000.

The Houston, East & West Texas has completed preparations for the erection of an addition to its machine shops at Houston, and work will begin at once. The new structure will be equipped with new machinery.

The Ohio River Railroad has prepared plans and asked for bids for building a new station at Sistersville, W. Va., two stories in height, built of brick and stone. This road has arranged for re-establishing division headquarters at Point Pleasant, at the mouth of the Kanawha River. New repair shops and roundhouses, etc., will be erected.

THE SCRAP HEAP.

Notes.

The United States Circuit Court of Appeals has decided in favor of the Government, sustaining Judge Ross, in the suit against the Southern Pacific Co., for possession of 700,000 acres of land in Southern California.

A press dispatch from McCook, Neb., last week reported that grasshoppers were so plentiful along the line of the Burlington road for 25 miles as to impede the passage of trains. Brushes are attached to the pilots of engines to clear the rails.

There was a strike of about 200 workmen in the freight car erecting shop of the Pennsylvania Railroad at Altoona last week, but the next day it was announced that the company had granted their demands. It is said that they were receiving about $13 per car for putting car bodies together, and that they struck for $25.

On June 18th the Supreme Court of Missouri filed an opinion declaring unconstitutional the law forbidding the discharge by corporations of employees who refuse to sever their connection with labor organizations. This law was enacted two years ago, and provides penalties ranging from a fine of $50 to $1,000 and six months' imprisonment. The court holds that this law is class legislation.

CAR BUILDING.

The Fall Brook Coal Co. this week gave out its order for 250 coal cars to the Union Car Co., of Depew, N. Y. These are 60,000-lb. hopper gondola cars and will have Fox trucks.

The Hainsworth Steel Co. has recently put into service at its Twenty-sixth street works, Pittsburgh, some platform cars, the sides and ends of which are made of 15-in. steel channels. These cars are used for hauling blooms, billets and pig iron. They are also equipped with Westinghouse brakes, Buckeye couplers and American continuous drawbars.

BRIDGE BUILDING.

Back River, Que.—The Provost bridge at Back River, near Montreal, needs renewing, and the municipalities interested are trying to determine who should build a new one, which would cost $5,000.

Buffalo, N. Y.—The Board of Public Works opened bids last week for the construction of an iron bridge over Buffalo River at the foot of Michigan street. The bidders were: Milwaukee Bridge and Iron Works, $59,680; Wisconsin Bridge and Iron Co., Milwaukee, $38,700; Rochester Bridge and Iron Works, $45,800; King Bridge Co., Cleveland, $51,300; the Buffalo Engineering Co., $28,375. The Board probably recommended that the contract be awarded to the Buffalo Engineering Co.

Burlington, Ont.—The new passenger bridge at Burlington, Ont., will be pushed forward as rapidly as possible. The bridge will cost over $30,000.

Carlisle, Pa.—The County Commissioners have completed plans and specifications for the new bridge which will span the Conodoguinet creek, near Middlesex. Bids will be received until June 9.

Casselman, Ont.—A new bridge is to be built across the Nation River, at Casselman, Ont., in place of the one swept away by the floods last spring.

Cincinnati, O.—The contract for the steel work to be used in reconstructing the bridge across the Ohio River, between Cincinnati and Newport, has been awarded to the Edgmore Iron Works. The contract includes 10,000,000 lbs. of metal work.

Freemansburg, Pa.—June 21, the County Commissioners opened bids at Easton, for erecting a new iron bridge over the Lehigh River at Freemansburg, to take the place of the present wooden bridge. The bids were as follows: Wrought Iron Bridge Co., Canton, O., $33,000 and $29,600; Havana Bridge Works, Mumford Falls, N. Y., Plan "B," $23,800; Iron Substruction Co., Columbus, O., $47,561 and $43,856; Detroit Bridge & Iron Works, $13,164 and $18,713.25; Nelson & Buchanan, Chambersburg, Pa., $28,800 and $26,500. New Columbus Bridge Co., Columbus, O., Plan "B," $27,840; Lehigh Valley Construction Co., South Bethlehem, $22,363 and $21,504; Variety Iron Works, Cleveland, $28,600 and $27,900; Plan "A" was for a two-span bridge and plan "B" for a one-span bridge.

Norristown, Pa.—Contracts for five county bridges were awarded by the commissioners last week. They will be steel structures over the Wissahickon Park, Perkiomen and Swamp Creeks, to cost in the aggregate $13,313. Benner & Opdyke, of Philadelphia, received the contract for the steel work for three bridges, amounting to $8,204. The steel work for the others goes to Ohio builders. The stone work for the bridges will cost $5,224.

Peterboro, Ont.—The government have granted $4,000 toward constructing a swing bridge at Rosa, six miles south of Peterboro, Ont.

Pittsburgh, Pa.—Progress on the Twenty-second street bridge is about as follows: One-half of the iron work of the north viaduct approach is erected; the foundations are all completed. The north shore pier is finished, and the north channel pier is half completed, and the south channel pier is about 51 ft., above low water. Beyond this no work has been done. The Shultz Bridge & Iron Co. are the contractors for the entire structure at $399,750; about $100,000 of which has been expended. Drake, Stratton & Co. are putting in the foundations. The Keystone Bridge Co. will furnish the channel spans.

Ridgefield Park, N. J.—The West Shore Railroad will bridge its tracks at Ridgefield Park station, N. J., for the convenience of passengers of the New York, Susquehanna & Western, who now have to cross the West Shore tracks to reach the station.

St. Anne, Que.—The contract for the bridge to be constructed over the St. Anne River, Que., under the direction of the Provincial Department of Public Works, will be given out shortly. For this work the Government has subscribed $9,500, and the municipality $15,000.

South Shore and Suburban Bridge Co.—The bill to enable this company to construct a bridge over the

St. Lawrence River at Montreal, has been defeated in Parliament.

Toronto, Ont.—The steel bridge built by the Central Bridge & Engineering Co., of Peterboro on Toronto Island, is now finished.

Valleyfield, Que.—A. and E. Loignon, bridge builders, Montreal, have finished the steel swing bridge over the Beauharnois Canal at Valleyfield. It is of the cantilever type, and is 90 ft. long.

Wabash, Ind.—The Lane Bridge Co., of Chicago, will at once remove its bridge works from that city to Wabash, Ind. The Wabash Bridge & Iron Co. has been organized with a capital of $60,000, all paid in, to manage the new works at Wabash. The directors are P. E. Lane, Chicago; John Darst, Toledo, O.; W. H. Roney, Dayton, O.; J. M. Harter, Warren Bunter, John Latchem, J. S. Daugherty, M. S. Howe and Oliver Bogue, Wabash. The company will erect at once large buildings, and will be running by Sept. 1, employing 150 men.

Wheeling, W. Va.—At the last meeting of the County Commissioners of Ohio County, W. Va., held at Wheeling, last week, the Committee on Roads and Bridges reported the contracts let to the Canton Bridge Co., of Canton, O., for the construction of two new bridges, and the plans prepared for four more. One of the bridges contracted for is located on Short Creek, in Richland District, and is to cost $1,490. The other is on the line between Ohio and Marshall Counties, and is to cost $2,152, and the expense is to be divided between the two counties. It is to be 190 ft. long and the main span will be supported by pillars of concrete in tubes. A new steel bridge is to be built on the National road at Sycamore Rock; another is to be built at Barney Crow's crossing, and another at Sundays, on the National road, and two others over the main stem of Wheeling Creek. The contracts for these latter bridges will be let later.

Wyoming, Pa.—The Wyoming Bridge Co. was chartered at Harrisburg, June 24, with a capital of $1,000, to build a bridge across the Susquehanna River at Port Blanchard. The Directors are: S. S. Herring, F. J. Scouten, D. O. McCollum, W. R. Chapin, V. L. Breese.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 3 per cent. on the preferred stock, payable July 1.

Chicago, Rock Island & Pacific, 50 cents per share, payable Aug. 1.

Columbus, Hocking Valley & Toledo, 2½ per cent. on the preferred stock, payable July 1.

Concord & Montreal, $1.50 per share, payable Aug. 1.

Connecticut River, semi-annual, 5 per cent., payable uly 1.

Little Schuylkill Nav., 3½ per cent. upon the capital stock, payable July 5.

National Railway Co., quarterly 1¾ per cent., payable July 10.

Norfolk & Southern, quarterly, 1 per cent., payable July 10.

Worcester, Nashua & Rochester, $2.50 per share on the capital stock, payable July 2.

Wrightsville & Tennille, semi-annual, 3 per cent. on both preferred and common stock, payable July 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Boston & Lowell, special, Boston, Mass., June 29

Concord & Montreal, special, White's Opera House, Concord, N. H., June 29.

Hancock & Calumet. annual, Hancock, Mich., July 9.

Marquette, Houghton & Ontonagon, annual, 301 Nester Block, Marquette, Mich., July 18.

Mineral Range, annual, Hancock, Mich.. July 9.

Negaunee & Palmer, annual, 301 Nester Block, Marquette, Mich., July 18.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Civil Engineers* will hold its annual convention at Nantasket Beach, commencing June 18.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month. at 2 p m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Tuesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago. The business meetings are held on the first Wednesday at its rooms. The meetings for the reading and discussion of papers are held on the third Wednesday at the Armour Institute, Thirty-third street and Armour avenue.

Freight Claim Association.

The Freight Claim Association will hold its semi-annual meeting in New York on Wednesday, Aug. 14, 1895. S. A. Mehorter, of the Pennsylvania Railroad, Philadelphia, is Secretary of the Association.

Engineers' Club of Philadelphia.

At the meeting of the Club, June 15, 74 members and visitors were present. President Geo. S. Webster occupied the chair. Mr. William D. Beatty read a paper on the "Philadelphia & Reading Coal Storage Plants." The next meeting of the club will be held Oct. 5.

Engineers' Society of Western Pennsylvania.

The Society met in Carnegie Hall, Allegheny, June 20. Its headquarters have been in Pittsburgh until recently. At the meeting a committee was appointed with instructions to procure headquarters in the business part of Pittsburgh, to which city the Society will again move as soon as possible. Mr. Leon Le Pontois read a paper upon the Efficiency of the Direct Methods of Converting Heat into Electrical Energy.

Master Car Builders' Association.

The following circular has been issued by the Secretary of the M. C. B. Association:

"The rules of interchange which go into effect Sept. 1 proximo, will provide, under Rule 8, that

"'Car owners will be chargeable with the repairs of their own cars when such repairs consist of raising a car so that the drawbars will come within the standard limits of 31⅛ in. to 34½ in. from top of rail to center line of drawbar, or, when they consist of the addition of handholds or grabirons to the car, all to conform to the requirements of United States law in these respects.'

"The Secretary was instructed to issue this notice at once, and to announce that this modification of the rule will take effect on July 1, 1895, and that rates of charge to car owners shall be as follows, to include all labor and material: Raising one end of one car, 50 cents; applying one handhold or grabiron, 20 cents."

Engineers' Club of St. Louis.

The Club met June 19, Vice-President Ockerson in the chair and 17 members and nine visitors present. The Executive Committee reported favorably on the applications for membership of Messrs. Clinton Kimball, J. J. Lichter, Jr., and H. H. Sykes. They were elected.

Mr. H. A. Wheeler addressed the Club on the subject of "Vitrified Brick for Street Paving." This material had long been used in Holland and in the North of England. It is now being employed in some 400 cities and towns in this country, including St. Louis, Chicago and New York. Mr. Wheeler defined "vitrified" brick, and explained the process of manufacture, etc. Shales furnish the best and most commonly used material. Fire clays are frequently employed satisfactorily. A necessity is slow cooling of the kilns. These brick are used for foundations, sewers and street paving, for which latter the speaker believed them to possess important advantages over all other material, being harder than granite. The use of vitrified brick for streets and sewers would permit the cleaning of the streets by the hydraulic system.

The discussion was participated in by Messrs. Kinealy, Crosby, Chauvenet, Baier, Harrington and Ockerson.

PERSONAL.

—Mr. E. C. Manson has been appointed Superintendent of car service of the International & Great Northern, a new office, the appointment being in effect since June 13.

—Mr. Edward K. Howes, for some years General Purchasing Agent of the Wisconsin Central Railway Company, died at North Greenfield, Wis., last week, aged 59 years.

—Mr. R. W. Cummings, Superintendent of the Cincinnati, Saginaw & Mackinaw division of the Grand Trunk Railroad, died at Saginaw, Mich., June 22, aged 32 years.

—Mr. H. L. Underwood, of Birmingham, has been elected General Manager of the Nashville & Mississippi Delta Railroad, which he purchased recently at foreclosure sale at Okolona, Miss.

—Mr. Joseph R. Moreland, a civil engineer of Wilmington, has been appointed Resident Engineer of the Great Western division of the Grand Trunk road, with headquarters at Hamilton, Ont.

—Mr. C. H. Koenig, District Passenger Agent at Cincinnati for the Baltimore & Ohio Southwestern, has resigned, to take effect July 1. The resignation has been accepted, and the office has been abolished.

—Mr. Chas. C. Cluff has been appointed General Eastern Agent of the Illinois Steel Company, and will look after all sales for this company in the Eastern territory, his office being at 46 Wall street, New York City.

—An examination for Chief of the Bureau of Highways of the City of Philadelphia will be held in that city on Monday, July 1, 1895. The examiners are Justus C. Strawbridge, John H. Converse and Edgar Marburg, C. E.

—Mr. Harry Bonn, at present Chief Clerk in the passenger department of the Atchison, Topeka & Santa Fe at Chicago, has been appointed General Passenger Agent of the Goodrich Transportation Co., operating a fleet of steamers on the great lakes. His office will be at Chicago.

—Mr. Wallace Rouse, Agent of Wells, Fargo & Co., at Brenham, Tex. has received a gold watch from his employers for repulsing a burglar who attacked him in his office. The burglar succeeded in getting hold of Mr. Rouse's pistol before he was discovered, and he slightly wounded the agent; but the latter got the better of him and drove him off.

—Mr. W. R. Calloway has been appointed General Passenger Agent of the Minneapolis, St. Paul & Sault Ste. Marie road, to succeed Mr. C. B. Hibbard. Mr. Calloway has been the Toronto representative of the Canadian Pacific for some time. Mr. Hibbard will leave at once to enter the duties of his new position as President of the Northern Adirondack of New York.

—Mr. George W. Hibbard, heretofore Northern Passenger Agent of the Duluth, South Shore & Atlantic Railroad, has been promoted to the position of Acting General Passenger Agent, vice Mr. C. B. Hibbard, who resigned to take the position of President of the Northern Adirondack road in New York. Mr. Hibbard's headquarters will be removed from Minneapolis to Marquette.

—Mr. L. B. Button, Superintendent of the Kansas division of the St. Louis & San Francisco, has been transferred to the St. Louis division, with headquarters at Springfield, Mo., vice Mr. W. A. Thoms, deceased, and Mr. A. O'Hara, Trainmaster on the Kansas City division, succeeds Mr. Button on that division. Mr. O'Hara was formerly a train dispatcher on the Indiana, Bloomington & Western.

—Mr. H. H. Houston, one of the Directors of the Pennsylvania Railroad, died at Philadelphia last week. Possessing sound judgment, clear perception and skill in organization, Mr. Houston's services had been called into requisition in the management of various corporations. He was a member of the Board of Directors of the Pennsylvania, the Pittsburgh, Cincinnati, Chicago & St. Louis; the Cumberland Valley; the Girard Point Storage Co.; the Pennsylvania Co., of Philadelphia; the Erie & Western Transportation Co.; the International Navigation Co.; the Pennsylvania Steel Co.; the International Steamship Co., and many smaller organizations.

—Mr. Roland C. Fraser, for the last eight and a half years the New England representative of the *Railroad Gazette*, has resigned that position to become Selling Agent of the New York Wood Vulcanizing Co. Mr. Fraser's headquarters are now at New York City and he has already entered upon the duties of his new position. Mr. Fraser is well and favorably known to a great many railroad officers. His genial personal qualities and energetic business abilities have made him successful in the field he now leaves, and we have no doubt that he will be equally successful in the new one.

—General Freight Agent Bissell, of the Atchison, Topeka & Santa Fe, has announced the following changes and appointments in the freight department of this company, to become effective July 1. Mr. A. P. Tanner having resigned to accept service with the Colorado Midland, the Assistant General Freight Agency at Denver is discontinued. Mr. C. H. Morehouse has been appointed General Agent Freight Department at Denver and Mr. T. M. Orr, General Agent, Freight Department, No. 212 Clark street, Chicago, vice E. Copland, assigned other duties. Mr. J. W. Tedford has been appointed General Agent, Freight Department, at Pittsburgh, vice T. M. Orr. Mr. R. H. Davis, appointed Commercial Agent, Freight Department, at Milwaukee, Wis., vice J. W. Tedford. Mr. J. C. Dietz, Traveling Freight Agent, has been transferred from Des Moines, Iowa, to Minneapolis, Minn. The General Agency, Freight Department, at Des Moines has been discontinued.

—Mr. Clinton L. Rossiter, who is at present Assistant Superintendent of the Western Division of the New York Central & Hudson River Railroad, is to be the new President of the Brooklyn Heights Railroad Co., Mr. E. G. Russell, Superintendent of the Rome, Watertown & Ogdensburg, who was offered the position, having declined it. Mr. Rossiter is expected to assume his new duties soon after July 1. The salary of the office is $12,000 a year. Mr. Rossiter will have charge of the practical rebuilding of all the lines of this railroad, one of the two largest electric roads in Brooklyn. Mr. Rossiter is a younger brother of the Treasurer of the New York Central & Hudson River Railroad and his first railroad work was in the finance department of that company. He was afterward Secretary of the Executive Board of the New York Central. He then became Assistant Superintendent and Superintendent of the Harlem Division. Two years later he was transferred to Buffalo as Assistant Superintendent of the Western Division Railroad. He is now about 35 years old.

—A number of important changes in the Faculty at Cornell University have been recently announced. Associate Professor Rolla C. Carpenter, who has been a member of the Cornell Faculty since 1890, has been promoted to the chair of experimental engineering. Professor Carpenter's work at Cornell is very widely known and needs no comment. He is the author of several books on experimental engineering, and at present has a work in press on Heating and Ventilating Buildings. Associate Professor Charles Lee Crandall becomes Professor of Civil Engineering in charge of railroad engineering and geodesy. He is the author of numerous technical works, and has done important work on railroad and government surveys. He has been connected with Cornell since 1874. Assistant Professor John H. Barr, who has taught at Cornell for the last five years, has been promoted to be Associate Professor of Machine Design. Associate Professor William F. Durand has been appointed Professor of Marine Engineering, and will be Principal of the graduate School of Marine Engineering and Naval Architecture, which has been so rapidly developed at Cornell, and is the only school of its kind at any of the universities in this country.

ELECTIONS AND APPOINTMENTS.

Chicago, Milwaukee & St. Paul.—A. B. Bridges, Commercial Agent at St. Louis, has been appointed Division Freight and Passenger Agent, with headquarters at Mason City, Io. J. G. Love, now Traveling Freight Agent, with headquarters at Milwaukee, will succeed Mr. Bridges.

International & Great Northern.—The office of trainmaster on this road has been abolished, and J. C. Gregory has been appointed Division Superintendent of the Gulf Division, with headquarters at Palestine, Tex., and Thomas Hume, Division Superintendent of the San Antonio Division, with headquarters at San Antonio. M. McDonough has been appointed Roadmaster of the Gulf Division, with headquarters at Palestine; R. G. Schott, Roadmaster of the San Antonio Division, with headquarters at San Antonio. These appointments abolish the office of roadmaster between Palestine and Galveston, formerly held by R. Gaunt. Messrs. Gregory and Hume were formerly Trainmasters.

Little Sawmill Run.—At a meeting of the directors of this company at Pittsburgh last week the resignations of ex-Judge Henry Hice, John S. Duss and Trustee Gotlieb Reithmueller, representing the Harmony Society, which built the road, were accepted, and J. D. Callery, William J. Burns and John S. Scully were elected in their stead.

Nashville & Mississippi Delta.—A meeting of the stockholders and directors was held at Okolona, Miss., June 17. The following officers were elected: Major R. H. Elliott, of Birmingham, Ala., President; Major H. L. Underwood, of Birmingham, Ala., General Manager and Treasurer; Judge J. W. Buchanan, of Memphis, Attorney.

New York, Susquehanna & Western.—Three members of the old board of directors, Alfred Sully, Charles Minzesheimer and H. W. Fuller, will retire at once. A. L. Hopkins and G. W. Young will then qualify as directors, to which positions they have already been elected, leaving one vacancy in the board. Ex-President Simon Borg will be the chairman of the board. The new board will consist of A. L. Hopkins, Simon Borg, H. O. Armour, T. McIntyre, C. C. Cuyler, G. A. Hobart, Henry Sanford, Roswell Eldridge, H. B. Plant, J. W. Ogden and G. W. Young, with one vacancy.

Plant System.—The office of Division Freight Agent at Montgomery, Ala., having been discontinued from July 1, Mr. Lee McLendon will retire on that day.

Southern Pacific Co.—J. T. Carothers has been appointed General Baggage Agent of the Pacific system, which includes the company's roads in California, Oregon and Nevada. The appointment was made to fill the vacancy caused by the death of C. L. Crabtree, who was General Baggage Agent for many years. Mr. Carothers was Station Baggage Master at the San Francisco ferries depot.

RAILROAD CONSTRUCTION

Incorporations, Surveys, Etc.

Addison & Pickens.—The engineers of this line, which is to be built from Pickens, W. Va., at the terminus of the West Virginia & Pittsburgh, to Addison, Webster County, have made sufficient progress to prepare for letting the contracts within a week. The work of construction is to begin in July and will be pushed in the hope of having the road ready for operation by winter. The counties of Webster and Upshur have donated $25,000 toward completing the road, and the remainder necessary to complete the 40 miles of road has been subscribed by the local property owners. The road is to follow the Black Fork of Elk River most of the way and it will open up a fine timber region. The rails and track supplies have already been contracted for. A. H. Kunst, of Weston, W. Va., General Manager of the West Virginia & Pittsburgh road, will have charge of the construction of the new line.

Atlantic & Lake Superior.—The directors of the proposed railroad announce that in view of misapprehension in regard to the nature of the guarantee upon the part of the Canadian Government with reference to the bonds recently offered for subscription in London, the company has directed all subscriptions to be returned.

Belton & Northeastern.—Chief Engineer Wambaugh has begun the survey of the road beyond Belton, Tex. It is to be continued to McGregor, Tex., about 20 miles. The company has been organized at Belton, Tex., and about $50,000 has been secured in local stock subscriptions.

Brainerd & Northern Minnesota.—This road has begun tracklaying on an extension north and west of Leach Lake, Minn. About 12 miles, beside branches, will be laid at once. This is the first road to touch the shores of this lake, which has a shore line of over 300 miles. Heretofore the district has been inhabited solely by Indians. The road is hauling logs to the boom limits at Brainerd, and will put in about 100,000,000 ft. during the summer.

Central of New Brunswick.—The company is to build a 15-mile branch from Chipman, N. B., to the Colonial Iron & Coal Co.'s coalfields at Newcastle. James Barnes, of Buctouche, is the contractor. The furnace to be erected at St. John is to have a capacity of 100 tons of pig iron a day. E. G. Evans, of Hampton, N. B., is General Manager of the company.

Chicago, Indianapolis, Rockport & Chattanooga.—The grading of the railroad has been progressing during the past month up the Ohio River bottoms. This road is projected to pass from Rockport, Ind., through Mitchell to Indianapolis. Aid has been voted the projectors in part of the counties through which it is to pass. A Mr. Cameron, of Chicago, is in charge.

Cleveland, Lorain & Wheeling.—This road is making extensive improvements in its roadbed over the first 15 miles west of the eastern terminus at Bridgeport, O. Six new steel bridges have been put up in that distance within the year, and six others are about ready for the foundations, which are building. At Bruce, about 12 miles west of Bridgeport, there have been two bridges since the road was first opened, but the work now being done, will do away with both of them, and place the track on solid foundation. The channel of Wheeling Creek is being changed about 30 ft. for a distance of half a mile, necessitating the excavation of nearly half a million cubic yards of earth. This change will also straighten the track throughout the distance, and do away with three of the most dangerous curves on the entire line. At Bannock, the wooden bridge is being replaced with a new steel structure, and just west of the east approach of the bridge, a cut has been made through the hill, doing away with a sharp curve which has been a source of annoyance and expense. Trains will be run through the cut this week.

Des Moines & Kansas City.—J. C. Newton, of Holyoke, Mass., President of the company, and General Manager Sherwood, of the road, have concluded arrangements to enter Kansas City by the projected Kansas City & Northern. The new line will connect with the Kansas City, Pittsburgh & Gulf road, thus giving a direct line from the gulf to Des Moines. The connection with the Kansas City & Northern, no part of which has yet been built, will be by an extension from the present terminus of the Des Moines & Kansas City in North Missouri.

Genessee & Wyoming Valley.—An extension of this line in Central New York to the town of Perry, has been talked of for some time. Last week Keon Barnes, of New York City, who has been chiefly interested in the project for extension, submitted a proposition to the townspeople of Perry, asking for local aid. He asked that subscriptions to the capital stock amounting to $50,000 be made, then the road would be built in four months. The road at present extends from South Greigsville to Caledonia, passing through Retsof, where the great salt mine is located, and connecting with the Erie, Lehigh Valley, Buffalo, Rochester & Pittsburgh, and the New York Central. The stock paid a dividend of seven per cent. last year.

Kansas City, Pittsburgh & Gulf.—Since Jan. 1 track has been laid on this road from Siloam Springs, Ark., to Barren Fork, in the Indian Territory, a distance of 18 miles, leaving a distance of 60 miles to the Arkansas River, under contract with B. Corrigan. From the Arkansas River to the point where the line crosses the state line between Arkansas and the Indian Territory, a distance of 57 miles, is under contract with Monroe & Lee, who also have the contract to build a spur from a point on the main line to the City of Fort Smith, Ark.

Track has been laid on the Texarkana & Fort Smith division from Allene north to Horatio, a distance of 14 miles. From Horatio north, a distance of 10 miles, is under contract with W. C. Merritt. Track has been laid from Texarkana south to a point two miles from Sulphur River, a distance of 8 miles, leaving 70 miles to Shreveport, under contract with H. C. Lindsley. The address of W. C. Merritt is Texarkana, and the address of the other contractors is Kansas City.

Le Roy & Northern.—R. L. Seldon is now surveying the right-of-way for the Le Roy & Northern, north of Le Roy, N. Y, and it is expected that work on the road will begin at an early day. The line is to be built through Genessee County, connecting the Le Roy salt works, stone quarries, and various factories with the trunk line railroads. C. F. Prentice and C. N. Keeney, of Le Roy, are directors.

Metropolitan Elevated (Chicago).—The main line of the railroad was last week opened to West Forty-eighth street, Chicago. This will give the company 10¼ miles of double and quadruple track in operation. Since the extension of the Milwaukee avenue line business has improved very materially. The road now in operation is as follows: Main line, four tracks, Franklin street to Paulina, 1.81 miles; Garfield Park line, Paulina street to West Forty-eighth street, 4.02 miles; Logan square line, Paulina street northwest to Logan square, 4.49 miles. The expectation is that the Humboldt Park line, extending north of North avenue west, will be opened for business in a few weeks, making the total mileage 12.45.

Mexico, Cuernavaca & Pacific.—The grading has been completed on an extension of seven kilometers from Fierro del Toro, the present terminus, to Xacapexco, in the State of Morelos. The rails for this section are now arriving, and track will be laid at once and the section opened to traffic by August 1 next. The line is under survey and final location from Xacapexco to Cuernavaca, 40 kilometers. The contractors are Wilson & Casad, of Mexico City.

Michigan Central.—The company is laying new rails, 80-lb. section on 28 miles of its track west of Niles, Mich.

Milltown & St. Stephen's.—This company is about to build five miles of railroad and bridges in New Brunswick to connect the Shore Line Railroad with the St. Croix & Penobscot. The company, in order to gain the subsidy, must begin work before August.

New Orleans & Western.—The Delta Construction Co., organized to build this road, announces that it will let contracts for constructing 30 miles of railroad line in and around New Orleans at once, also for building a grain elevator on the Mississippi River, below New Orleans.

New Roads.—The funds to build a new railroad from Oshkosh to Berlin, Wis., have been secured in Milwaukee. The contract for the work is let to Charles Martin and John Martin, of Oshkosh. The right-of-way for the entire distance has been obtained. Starting from West Algona the line will pass Oakwood and Omro, and extend thence southwesterly, through the village of Eureka to Berlin, a total distance of 22 miles. The Chicago, Milwaukee & St. Paul connects Oshkosh with Berlin by way of Ripon, a very roundabout way, so much so, that stages are run between the two towns.

Northern Pacific.—Judge Jenkins has authorized the Receivers to enter into a contract with the Parrott Silver & Copper Co., whereby the mining company is to build four miles of track at a cost of $63,000. The track is to be built from White Hall in Montana. The mining company is about to erect a smelter and agrees to advance the money to build the track. Repayment is to be made by the Receivers, by allowing the mining company 50 per cent. of the freight charges on material to the smelter on account, and 50 per cent. on ore hauled until the amount is paid up.

North State Lumber Co.—A new railroad is to be constructed by this company, to be about 60 miles in length, standard gage, and pass through the timber lands in the eastern section of North Carolina, owned by the lumber company. A connection will be made with the Cape Fear & Yadkin Valley road at a point near Fayetteville, N. C. The survey has already been made. The offices of the North State Lumber Co. are at Goldsboro, N. C.

Ohio River & Charleston.—A special meeting of the stockholders of the company has been called for the purpose of authorizing the issue of a sufficient amount of bonds to complete the road to the bituminous coal fields of Virginia. The Investment Company of Philadelphia holds a large amount of the securities of the company. A portion of the road is already built, 171 miles from Camden to Marion, S. C.; 20 miles between Johnson City and Unaka Springs, Tenn.; and 8 miles between White House and Richardson, Ky.

Peace River Phosphate Mining Co.- This company is building a standard gage road from Arcadia to Liverpool, Fla., a distance of 15 miles, for the purpose of hauling phosphate rock from its various plants along Peace River, to Liverpool and shipping thence by water. Terminals are being constructed at Liverpool arranged for dumping the rock from the cars on to lighters. The grading is practically completed, and the track is laid from Liverpool seven miles northward. Work was commenced in February last and the entire line will be completed about August 1. Joseph Hull, of Savannah, Ga., is President; H. M. Comer, Jr., Punta Gorda, Fla., is General Manager, and Arthur Pew, Arcadia, Fla., is Chief Engineer.

Peninsular.—George F. Gund and Alfred H. Anderson, of Seattle, Wash., have filed articles of incorporation of the company organized to construct a road from Big Skookum or Hammersley's inlet, on Puget Sound, in a northwesterly direction to a point on the Straits of San Juan de Fuca. The capital stock is placed at $300,000.

Pennsylvania.—The contract has been awarded for the extension of the South Chester Railroad, a branch of the Pennsylvania, to the Delaware state line. The South Chester Railroad leaves the main line of the Philadelphia, Wilmington & Baltimore Railroad, in Chester, Pa., just below the Lamokin Station, and extends along the river front, paralleling the Philadelphia & Reading's Chester branch to Marcus Hook.

Pittsburgh, Belizhoover & Knoxville.—This company, which proposes to build a tunnel through Mt. Washington, opposite the south side end of the Smithfield street bridge at Pittsburgh, has received several bids for the work, but so far none have been accepted by the Board of Directors. Some definite decision will, however, be taken in a few weeks, according to Mr. James M. Bailey, of Pittsburgh, President of the company. The tunnel will be 3,600 ft. long.

Pittsburgh & Eastern.—P. McManus of Philadelphia, who has the contract for the building of the first division of the road, extending from Mahaffey to Rankin Summit, Pa., a distance of 20 miles, is pushing the work forward with great rapidity. He has 1,500 men engaged, at various points along the division. The work as a whole is rather heavy and will average 60,000 cubic yards to the mile. The contract calls for the completion of the work by October 1.

Racquette Lake.—The New York State Railroad Commission has granted the application of the railroad for permission to construct a steam road from Racquette Lake to Axton, N. Y., in the Adirondacks. Charles E. Arnold, of Albany, is the promoter of this road, in connection with the Saranac & Lake Placid and other Adirondack roads in which he is financially interested.

St. Louis, Pomona & Southern Company.—This company was organized at Fort Smith, Ark., recently, the company being already incorporated in Missouri. The Directors are H. D. McKay of St. Louis, W. K. Kreybill and J. E. Kreybill of Pomona, Mo., Frank Parke, John Mathers, George Sengle, D. J. Young and ex-Governor Fishback of Fort Smith. The road will extend from Pomona, Mo., to Fort Smith, through the Mineral counties of Madison, Boon, Newton and Marion. H. D. McKay is the chief promoter.

Santa Fe & Cochiti.—The Engineer, William Garstin of Colorado Springs, has completed the preliminary survey of this new railroad from the Crown Point mine above Bland to Allerton, N. M., a distance of about seven miles, and the work is steadily progressing toward Santa Fe. The line will be surveyed from Allerton to the Rio Grande at the mouth of White Rock Cannon early in July.

Southern Pacific.—General Manager Kruttschnitt, reports that the second track work between Morgan City and New Iberia, La., is making good progress, a great deal of the grading having been already completed. The Southern Pacific is making extensive improvements at Algiers, opposite New Orleans. The company has purchased considerable lands there, and it is likely that there will be an extension of the machine shops and terminal facilities, along with the building of the new slip and other additions.

Spokane Terminal.—This company has been organized at Spokane, Wash., by S. Oppenheimer, W. R. Newport, E. J. Dyer, M. M. Cowley, Jacob Hoover, S. S. Glidden, M. Thompsen, to build a terminal railroad at Spokane.

Trinity, Cameron & Western.—The Board of Directors it is announced, have accepted a proposition of New York capitalists to furnish money to complete the line between Georgetown and Granger, Tex., and it is stated that portion of the road will be finished at once. President Emzy Taylor and ex-Governor Hogg, attorney of the company, were in New York City some weeks ago to negotiate a sale of the bonds, but had not been able to arrange to dispose of the issue when they left the city.

Tunnelton, Kingwood & Fairchance.—This road, which was built a narrow gage, from Tunnelton, on the Baltimore & Ohio, to Kingwood, Preston county, W. Va., 20 miles, several years ago, is being widened to a standard gage. The long cut near Tunnelton has been widened, and Manager J. A. Martin states that the ties have all been laid, and the roadbed prepared, and the new rails in place in 30 days. An extention of the road to Morgantown is proposed, and it is possible the work may begin this summer, although the preliminaries will probably occupy the time till next fall. Other particulars of this work were published in this column, p. 305, May 10.

Unadilla Valley.—The completion of this road this week to the southern terminus at New Berlin, on the New York, Ontario & Western, makes a very direct line from Wilkesbarre, Scranton and the coal fields of Pennsylvania to Utica, N. Y. The route is via the New York, Lake Erie & Western and Delaware & Hudson Canal Co.'s roads to Nineveh, Delaware & Hudson to Sidney, New York, Ontario & Western to New Berlin, Unadilla Valley to Bridgewater, the northern terminus of the road, and thence by the Delaware, Lackawanna & Western to Utica. At present, in hauling coal to Utica via the main line of the New York, Ontario & Western two engines are required to haul 10 cars over the "summit;" or by way of the Delaware, Lackawanna & Western the hill at Paris, with a grade of about 175 ft. to the mile, has to be climbed. The new road has no grades exceeding one-half per cent. The road has been substantially constructed, and the rolling stock is first-class throughout. The entire line from New Berlin to Bridgewater, 19¼ miles, will be opened for regular traffic early next week. George L. Rusling, of 137 Broadway, New York City, was the contractor. The General Manager of the road is Mr. F. F. Culver.

Virginia, Fredericksburg & Western.—The preliminary survey for the railroad was completed last week from Fredericksburg, Va., to the Chesapeake Bay by the two parties of surveyors, under W. A. Hankins, Chief Engineer.

Washburn, Iron River & Western.—Articles of incorporation of the company have this week been filed in Wisconsin. The preliminary survey will be made at once, and an effort will be made to build the first 30 miles of the road to a connection with the Northern Pacific at Iron River, will be built this summer. An extension will be made to Sandstone, Minn., to connect with the Great Northern is proposed for next year.

Washington & Great Falls Electric.—At a meeting of the shareholders of the company, at Washington, D. C., last week, the offer of Stilson Hutchins to purchase the $100,000 six per cent. gold bond issue, part of the $500,000 issue authorized, was accepted. The new Directors elected the following officers: J. P. Clark, President; S. T. G. Morsell, Vice-President; Lee Hutchins, Treasurer, and W. E. Lewis, Secretary. The contract for the construction of the road will be let and work commenced at once.

Western of Alabama.—The company will construct at once a railroad from Cowles Station to Tallassee, Ala., to enable it to handle the product of the cotton factory at Tallassee Falls.

West Virginia, Ohio River & Western.—In an interview last week, Ex-Senator Johnson N. Camden, of Parkersburg, W. Va., who is at the head of the Ohio River, Monongahela River and the West Virginia & Pittsburgh Railroads, stated that the work of building a railroad to connect all these lines, and to run from a point on the West Virginia & Pittsburg to the Ohio River, would be commenced this summer. The surveys have not been completed, and the line is not definitely decided upon, there being two routes under consideration. But both lines have been surveyed, and the selection of a route will depend entirely upon the cost of construction, which will have been decided within a few days. The routes under consideration are along the West Fork River and the Bingammon Creek, the former being known as the Ten-Mile route, and having been surveyed several times. It is the general impression that the Bingammon route will prove the cheapest and will be decided upon. The road will probably begin on the Harrison county side of Bingammon creek, and follow that side to Wyatt, and from Wyatt, along a newly surveyed route to the Ohio River. The road is to be built for the purpose of furnishing an outlet to the Fairmont and Harrison County coal fields to the West, those fields being now dependent upon one line. Senator Camden said he hoped to have everything in readiness to begin work in July, but it is likely that it will be longer than that before actual construction will begin. A conference was held by Senator Camden and the management of the Wheeling & Lake Erie railroad at Wheeling last Friday, at which the plans were laid for a traffic arrangement for carrying Fairmont coal to the west from the new road. The original plans for the West Virginia, Ohio & Western contemplated the building of a bridge over the Ohio River at New Martinsville, but it is not probable that this will be undertaken for the present. A connection with the Wheeling & Lake Erie or one of the other Western lines which can be reached at Wheeling

by way of the Ohio River road and the Wheeling Terminal Railroad Co., and its bridges would serve the same purpose.

Winnipeg & Hudson Bay.—The promoters of the railroad have submitted an amended proposition to the Canadian Government. Instead of a loan of $10,000 a mile for 250 miles, the government taking all properties of the company as security, they propose now an advance of $6,000 a mile, the government taking the land grant and postal subsidy of $80,000 a year as security. The projectors state that if this proposition is accepted they will build 125 miles of new road this year. The locating surveys are now being made by Alexander Stewart, Chief Engineer. Grant, Foley Bros. & Guthrie, who will build the section undertaken this year, have already let many of the sub-contracts, and the grading has been started.

GENERAL RAILROAD NEWS.

Atlanta & Florida.—The Southern Railway has bought the Atlanta & Florida. The line is 104 miles long and extends from Atlanta south to Fort Valley, Ga., through a fruit section. The price paid was about $275,000. The Southern buys it from the Central Trust Co., of New York, which purchased the road at the recent foreclosure sale.

Augusta & Savannah.—The directors of this company, one of the leased lines of the Central of Georgia, have formally ratified the plan of reorganization of the Central of Georgia recently issued by Messrs. Samuel Thomas and Thomas Ryan, so far as the terms of the reorganization affect this railroad. The company controls 50 miles of railroad south of Augusta, Ga., to Millen.

Baltimore & Ohio.—The Directors have decided to pay the customary dividend of three per cent. from the earnings for the six months ending June 30, on the preferred stock of the company. The statement of the receipts for May shows a net increase of $124,570. For the 11 months ended May 30, the receipts were $20,618,026, as against $20,766,076 in 1894. The expenses for 1895 were $14,546,905, and for 1894, $14,470,579, showing a net decrease of receipts over expenses of $223,376.

Baltimore Belt.—Messrs. Ryan & McDonald, contractors for four sections of the Baltimore Belt Line Tunnel, at a contract price of $1,700,000, this week filed a suit against the Maryland Construction Co. for $900,000, claiming that the construction plans were changed so as to make the work much more expensive than the contract indicated, and that the construction company has failed to pay the greater part of the original contract price.

Chesapeake, Ohio & Southwestern.—The Board of Directors Louisville & Nashville have decided to carry the Chesapeake, Ohio & Southwestern litigation to the Supreme Court of the United States. The recent decision of the Kentucky Court of Appeals affirmed the decision of a lower Court in favor of the Commonwealth of Kentucky. The Illinois Central Railroad is not a party in the litigation.

Chicago, Peoria & St. Louis.—The control of this property has passed from the Cairo Short Line to the St. Louis, Alton & Terre Haute. The transfer of the property to that company will give it important connections with the coalfields in Central Illinois, reached by the Chicago, St. Louis & Pittsburgh. The latter company operates 170 miles of railroad.

Cincinnati, Hamilton & Dayton.—A special meeting of the stockholders will be held in Cincinnati July 8, to authorize the consolidation of all the properties now included in the system. This will unite the Cincinnati, Hamilton & Dayton, the Cincinnati, Dayton & Ironton, and the Cincinnati, Dayton & Chicago. The authorized capital of the three companies is $23,000,000, of which $14,742,000 is outstanding. The deal purposes $8,000,000 of common and $8,000,000 of preferred stock.

Concord & Montreal.—The Directors of the railroad have approved the terms of the proposed lease of the line to the Boston & Maine, as fixed by the joint committees in Boston recently. The special meeting of stockholders to act upon the matters has been called for June 29.

Harriman Coal & Iron.—The railroad property of the Harriman Coal & Iron Railroad Co., located at Harriman, Tenn., is to be sold at that city on July 20, under a decree of the United States Circuit Court at Knoxville. The decree was issued in a suit brought by the Central Trust Co. of New York City and other trustees of the mortgage executed in December, 1892. The railroad now operated by the company extends from a point in the city limits of Harriman, connecting with the East Tennessee, Virginia & Georgia at the Emory River, near Walden's Ridge or Big Emory Gap. The line follows Emory River to Webster and De Armond, and along various streams to the coal mines of the State of Tennessee, the total length of the line being 14 miles. The upset price of the property fixed by the court is $200,000.

Kansas Central.—Judge Sanborn has issued an order in connection with the foreclosure suit of the New York Security & Trust Co., against the railroad, authorizing the receivers to execute $150,000 of receivers' certificates to provide funds for repairing the roadbed and rebuilding bridges, and to pay certain sums due the Union Pacific receivers.

Knoxville, Cumberland Gap & Louisville.—This railroad will be sold by Special Master James Maynard, July 22, at Knoxville, Tenn. The upset price is $500,000. The road extends from Knoxville north to the Cumberland Gap tunnel, 74 miles. The road has been operated by Clarence Cary as receiver since Dec. 1, 1892.

Macon & Northern.—The bondholders of the railroad have rejected the proposal to join in the reorganization of the Central of Georgia Railroad, formulated by Messrs. Samuel Thomas and T. J. Ryan. The reason for the rejection was that the terms offered under the reorganization plan were deemed unsatisfactory. The Macon & Northern was formerly operated jointly by the Central of Georgia and the Richmond & Danville. The interest, which was guaranteed jointly, has been unpaid since March, 1893. The railroad is 109 miles long from Macon to Athens.

Mammoth Cave.—Application was made at Glasgow, Ky., last week, for a receiver for this railroad, which is operated between Glasgow Junction on the Louisville & Nashville and the Mammoth Cave, a distance of something over eight miles. The road is operated by the Louisville & Nashville, but maintains an independent organization. The line has no freight traffic, its only revenue being from passengers to the Mammoth Cave. The rates of fare are very high, about $5 we believe, and this high rate has encouraged maintenance of other means of reaching the cave, and it is said that practically all the travel goes by carriages. It is understood that this application for a receiver is part of a plan of the Louisville & Nashville to make it possible to secure reduced rates over its leased line.

Middlesboro Belt.—This railroad was sold at public sale June 12, on order of the United States Court, and was bought in by the bondholders, represented by F. W. Whitridge, for $30,000.

Middlesex Valley.—It was announced last week that the Lehigh Valley had purchased a majority of the stock of this railroad. The line is about 30 miles long, and was built in 1892 and 1893 from Naples to Geneva, in Ontario County, N. Y., at the head of Seneca Lake.

New York & New England.—Two suits to restrain the foreclosure of the mortgage have been filed in the United States Circuit Court at Boston. The plaintiffs are A. Roberts, of New York, and B. S. Hart, of Brooklyn, N. Y. The bills allege that the decree for foreclosure was made in two suits, one of T. F. Wood, the other of W. T. Hart; that in one case the court had no jurisdiction to order a foreclosure, because it was simply a bill for the appointment of a receiver, and that in the other case it also had no jurisdiction.

Northern Pacific.—The receivers have been authorized by Judge Jenkins, in an order filed in the United States Court, to pay the semi-annual interest due July 1 on the general first mortgage bonds of the company, and also the amount required to be paid into the sinking fund provided for therein. The interest amounts to $1,275,630, and the amount placed in the sinking fund to $367,375.

Ohio Southern.—Messrs. John I. Waterbury, James D. Smith and Jules S. Bache, of New York have been requested by the holders of a large amount of second mortgage 4 per cent. bonds and of the stock of the company, to act as a committee to formulate and carry out a plan for the reorganization of the company.

Oregon Short Line & Utah Northern.—The committee of bondholders have voted not to accept the separate receivership on the terms offered by the court. It will be remembered that the United States courts having jurisdiction, except the court in Utah, agreed to the appointment of Mr. Egan as separate Receiver on the payment of the overdue interest on the first mortgage bonds. Judge Merritt appointed both Mr. Egan and Mr. Bancroft General Division Superintendents of the Union Pacific, as joint Receivers.

A motion was filed at Salt Lake City, June 21, by the attorneys for the American Loan & Trust Co. for a modification of the recent order of Judge Merritt appointing receivers for the railroad in Utah, so as to make J. M. Egan sole Receiver and give him authority to issue receiver's certificates and allow him to take possession of the road without paying the interest on the Utah Southern & Utah Southern Extension bonds. The case will come up for argument before Judge Merritt this week.

Rockaway Valley.—The railroad has been advertised for sale on July 15, under foreclosure proceedings brought by the Farmers' Loan & Trust Co., of New York. The road extends from Whitehouse to Morristown, N. J.

Santa Fe Southern.—Officers of the Denver & Rio Grande purchased this property, generally known as the Texas, Santa Fe & Northern, at the recent foreclosure sale at Santa Fe, N. M. The line is narrow gage about 30 miles long, extending north from Santa Fe to Espanola, N. M., where a connection is made with the southern terminus of the Denver & Rio Grande Railroad. The company has been involved in litigation for a number of years and the railroad has been practically operated by the Denver & Rio Grande for some time. The sale was made and the suit brought by the Farmers' Loan & Trust Co., of New York City, trustee of the first mortgage bonds.

Washington Southern.—This railroad, operating about 40 miles of line in Mason County, in Western Washington, was sold at foreclosure at Shelton, Wash., last week by Isaac Dobson. The property was purchased by J. D. Lawman, of Seattle, for $49,000, the purchaser representing the local creditors of the company. The railroad was built two or three years ago entirely to open up lumber lands in Mason County, one of the counties west of Puget Sound.

Wisconsin Central.—Judge Jenkins, of the United States Circuit Court, has issued an order calling on the receivers of the Wisconsin Central Company to make a report of the financial and physical condition of the property as soon after July 1 as possible, and thereafter file like reports on Jan. 1 and July 1. Judge Jenkins says the receivers have made no general report respecting the management of the railroad.

TRAFFIC.

Traffic Notes.

The local passenger agents of San Francisco and Oakland have formed a new association. There are 22 members.

The freight bureau at Denver was given up several months ago, but it seems that a good many of the merchants still believe that such an establishment is necessary, and there is another movement on foot to see if one cannot be supported.

It is estimated that the quantity of coal now loaded upon boats at Pittsburgh, and waiting for a rise in the Ohio River, is 600,000 tons, equal to 20,000 carloads of 30 tons each. The boatmen fear that they may not have a coal boat rise before Autumn.

The meeting of the Southern Railway & Steamship Association, held in New York last week, was adjourned to July 16, by which time it is expected that all the roads will have considered the committee's report and be ready to act on the proposition to continne the association. It is hoped to abopt a contract which will not have to be renewed each year.

The lines between Pittsburgh and Cleveland, the Cleveland & Pittsburgh and the Pittsburgh & Western have quickened the time of their fast trains The St. Louis, Iron Mountain & Southern has shortened the time of train No. 54, which now reaches St. Louis from the South at 10:05 p. m., instead of 6:05 a. m., as heretofore. Arriving in the evening, it connects with fast trains eastward over the Vandalia and the Baltimore & Ohio Southwestern.

Cotton Rates to Houston and Galveston.

The attempt of the merchants of Galveston to secure a decision from the courts abolishing the freight differential of 6 cents per 100 lbs. on cotton between that city and Houston has failed. The suit was that of W. H Ladd & Co. against the Railroad Commissioners, who fixed the freight rate, and the decision was handed down on June 21 by Judge Morris, holding that the plaintiffs had no case. The controversy concerned the freight rates on cotton from interior Texas points to Houston and to Galveston, which is from 30 to 50 miles farther than to Houston according to the route taken. After much controversy between rival carriers the State Railroad Commissioners some months ago decided that rates to Galveston should always be 6 cents per 100 lbs. higher than to Houston. The court finds that practically all the cotton goes to markets beyond Galveston, and that it appears from the evidence that cotton shipped from Houston costs six cents per 100 lbs. more at the ultimate destination than does cotton shipped from Galveston. It, therefore, appears that Galveston has an advntage over Houston instead of Houston having an advantage over Galveston, as was claimed by the plaintiffs. It is true that the tariff gives Houston an advantage, not over Galveston, but over the conditions which would exist without this tariff. Houston cannot claim this advantage as a matter of right, but as long as she enjoys the advantage, and it does not more than place her on an equality with Galveston, the latter city cannot complain.

Chicago Traffic Matters.

CHICAGO, June 26, 1895.

Eastbound shipments by rail last week showed considerable increase, owing doubtless to the stimulus of low rates. Lake shipments were very light, especially grain shipments, of which there were but 60,000 bush. wheat and 788,634 bush. corn shipped. The iron ore carrying trade continues good, and is about all the lake lines are depending on. Lake rates on grain are weak, as low as 8¾ mills a bushel being accepted to Buffalo.

On account of the agreement of the southwestern lines to restore freight rates on the 29th, there was little cutting reported. In fact the bottom had been reached, and there is now no incentive to cut deeper. A meeting is to be called next month and an attempt made to formulate an agreement for the distribution of business which will work.

The eastbound freight situation is the worst that has been known for a long time. The Chicago & Grand Trunk last week determined to stand no more fooling and openly reduced rates on grain and its products to 15 cents, Chicago to New York; 17 cents to Boston and New England points, a reduction of 5 cents per 100 lbs. The Erie followed suit by announcing an open tariff effective yesterday, meeting the rates of the Grand Trunk on grain and including in the cut of 5 cents provisions and all fifth and sixth class commodities and making the reduction apply not only to New York but also to Boston, Baltimore, Philadelphia, Washington and all interior points. These reductions have been met by all the other lines, and unless the meeting which is in session to-day succeeds in patching up a truce the indications are that all the roads will proceed to indulge in a rate war of unusual proportions. It is hardly credible, however, that the managers of the eastbound roads will be so short-sighted as to fail to make a new agreement and put a stop to the foolishness as soon as possible.

No progress has been made toward a reorganization of the Western passenger associations and no further attempt will be made until next month, by which time it is hoped that the Union Pacific will be in a better frame of mind. However, it does not seem to be the fault of any one road in particular that no agreement is reached, as it is first one and then another that is unwilling to join.

The Alton and the Wabash have finally agreed to leave the disputed question of St. Louis-Kansas City rates to a board of arbitration consisting of general passenger agents Nicholson, of the Santa Fe, and Daly, of the Lake Erie & Western. The question in dispute is whether the Alton is justified in charging $7.25 from East St. Louis to Kansas City, being the St. Louis rate, because it operates its own bridge, or whether it should maintain the old rate of $7.50, which includes the 25-cent bridge charge which the other roads have always included. The Wabash and the Missouri Pacific contend that the Alton should charge the old rate of $7.50, while the latter insists that it is entitled to some consideration because it owns a bridge of its own.

The other Western lines have concluded that it would be foolish to make freight rates to Utah and Colorado common points lower than those announced by the Union Pacific, and will content themselves with meeting the rates made by the latter. The new rates from the Missouri River to Colorado common points, effective July 1st, are:

1	2	3	4	5	A	B	C	D	E
140	120	100	80	65	75	55	45	40	85

The Illinois roads have agreed to accept the new classification to be made effective by the State Board of Railroad and Warehouse Commissioners on July 1st, without further protest. The new classification will have the effect of equalizing rates from Chicago to interior points in Illinois with those which are made from Indianapolis, Detroit and other jobbing centers which have been able to make lower rates than from Chicago, by using the official classification. This is the outcome of the fight which has been made by the Chicago Freight Bureau, and which has been fully covered in these columns from time to time.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines for the week ending June 22, amounted to 52,462 tons, against 45,786 tons during the preceding week, an increase of 6,676 ton and against 44,599 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	WEEK TO JUNE 22.		WEEK TO JUNE 15.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	3,506	6.9	2,920	6.4
Wabash	5,302	10.1	3,527	8.7
Lake Shore & Mich. South.	9,705	18.4	5,698	12.3
Pitts., Ft. Wayne & Chicago	7,887	15.0	5,919	13.0
Pitts., Cin., Chi. & St. Louis.	6,435	12.3	7,598	16.5
Baltimore & Ohio	4,120	7.9	4,321	9.4
Chicago & Grand Trunk	1,974	3.8	2,038	4.4
New York, Chic. & St. Louis	6,355	12.1	5,578	12.1
Chicago & Erie	5,352	10.2	6,738	14.7
C., C., C. & St. Louis	1,766	3.3	1,651	3.5
Total	52,402	100.0	45,786	100.0

Of the above shipments 1,340 tons were flour, 20,983 tons grain and mill stuff, 10,618 tons cured meats, 8,648 tons dressed beef, 2,324 tons butter, 1,241 tons hides, and 5,620 tons lumber. The three Vanderbilt lines carried 37.4 per cent.; the two Pennsylvania lines 27.3 per cent.